

THE
SUBTIL MEDIUM
PROV'D:

OR, THAT

Wonderful Power of NATURE,
So long ago conjectur'd

BY THE

Most Ancient and Remarkable Philosophers,
Which they call'd sometimes

Æ T H E R,

But oftener

ELEMENTARY FIRE,
V E R I F Y ' D.

Shewing, That *all* the *distinguishing* and *essential Qualities* ascrib'd to *Æther* by them, and the most eminent modern Philosophers, are to be found in electrical Fire, and that too in the utmost Degree of Perfection.

GIVING

An Account not only of the Progress and several Gradations of Electricity, from those ancient Times to the present;

But also accounting,

First, For the natural Difference of electrical and non-electrical Bodies.

Secondly, Shewing the Source or main Spring from whence the electric Matter proceeds.

Thirdly, Its various Uses in the animal *Œconomy*, particularly when apply'd to Maladies and Disorders incident to the human Body. Illustrated by a Variety of known Facts.

Fourthly, The Method of applying it in each particular Case. And,

Lastly, The several Objections brought against it accounted for and answer'd.

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T O T H E
R E A D E R.

AS no small Part of my Time and Thoughts have, for six or seven Years past, been employ'd in electrical Experiments, and particularly such Experiments as were found to have salutary Effects on the animal Cconomy, when apply'd to Disorders, incident to the human Body ; so, I am fully satisfy'd, the more they are enquir'd into, the more wonderful they will appear : And, observing a Series of such salutary Effects, I was determin'd to publish something of this Kind, in Hopes to excite others, of greater Abilities and more Leisure, to pursue the same laudable Practice, being thoroughly convinc'd Mankind would find their Account in so doing.

But, before I set about it, I consider'd, that, to shew I proceeded on rational Principles, something ought also to be said concerning the Nature and Qualities, in general, of the subtil Agent, which was the Cause of such salutary Effects ; and not only so, but also endeavour, in a rational Way, to explain the Manner of its Acting, that so it might appear agreeable to Reason to expect the great Things from it, which I was going to relate : This must be the *first* and chief Apology for the following *Essay*. And the

Second, Because I had observ'd, that not a few, even of the judicious Part of Mankind, seem'd thoroughly persuaded, that the electrical Phænomenon was of so abstruse a Nature, as to be scarce explicable on any rational Principles whatsoever.

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Thirdly, Because no Pen whatever had, I thought, pursu'd the Subject so thoroughly as might have been wish'd: Those who had wrote their Thoughts concerning its Nature, Properties, and Production, being, for the most Part, quickly after the late great Improvément or Discovery of the Shock; for this Reason, they seem'd to have done it too precipitantly, and perhaps the Subject was treated too superficially; because here they stopp'd, altho' there was sufficient Room to have proceeded still much farther*: These were undoubtedly the Reasons why it was not more fully explain'd, before this Time, at least, so as to have left less Room to pronounce it inexplicable; particularly as many of the Gentlemen who wrote their Thoughts on Electricity, were posseſſ'd both of eminent Parts and great Learning, and therefore far better qualify'd to undertake it than I could pretend to be, who, I must confess, am quite unequal to the Task. And must therefore,

Fourthly, Beg to be excus'd for presuming to undertake it, who am unhappily depriv'd of those acquir'd Abilities of polite Education, which are, in the Eye of the World, thought necessary to draw the Attention of others, or raise their Expectation of Success: But, as an ingenious Author hath very justly observ'd, Truths, Facts, and demonstrative Experiments are no Slaves to *Latin* and *Greek*, whatever *Men* are; therefore, so much as can be plainly and clearly made appear by one in such a Situation as the Author, will be allow'd to be the Effect of undisguis'd Truth only, as depending principally on Facts.

* My Meaning is: The Experiments and Chain of Reasoning thereon were discontinu'd, before a competent Number of such leading Experiments were made as were necessary to conduct to a more clear Discovery of the Cause that produc'd such a wonderful Phænomenon.

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But as it will be obvious to all, that great Difficulties must occur to one thus circumstanc'd, more than to such as are accustom'd to write; so it is hoped the candid Reader will make suitable Allowances.

My Meaning is, that the Style and Diction may be excus'd, if it does not always keep up strictly to the Nicety of Grammar Rules, such as a false Point, a small Tautology, an unphilosophical Term, or even an undue Connection; yet, I shall not, I hope, be deny'd the Advantage of a fair Hearing, as far as I can be supported by plain Facts and Experiments.—And, that there might not sometimes seem a Chasm, when I, perhaps design'd a Connection, was the chief Reason for my writing by Way of *Dialogue*.

As to the Subject-matter, I neither expect or desire any other Favour, than such a candid Hearing; for, as the Reasoning is chiefly founded on proper Experiments, it is presum'd, that Part will be found capable of supporting itself.

In order, therefore, to proceed on the most rational Principles, and to shorten the Work as much as possible, I have not only taken Sir Isaac Newton for my Guide, whenever it was consistent with what I was explaining, but have also taken for granted whatever he has deliver'd on the Subject of a universal Æther, as to its Nature, Properties, and great Utility; and then proceeded by Way of *Quæries*, and Proofs by Experiments; and, where Experiments could not be fairly produc'd, have endeavour'd to account for it by the most rational Arguments alone.

But perhaps it may be thought, that the greatest Reason of all, for an Apology, ought to be for my advancing some Things which may appear a little heterodox, and something different from certain Philosophical Points, which, for a considerable

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Time past, have been settled, as undeniable, by the greatest Philosophers. Whereas,

If I were allow'd to speak my Mind freely, it is my humble Opinion, that, were those great Philosophers still living, to see the wonderful Experiments which are made in Electricity, they would not be so tenacious of their former Opinions, as to think there was not sufficient Reason, now, for altering many of their Sentiments, how differently soever their present Disciples or Devotees may think or act.

Those great Philosophers, notwithstanding their former settled and undeniable Principles, would, no doubt, after so grand a Discovery, have set to work, and new-modell'd many of their philosophical Plans, or erected new ones, in order to have penetrated still deeper into the Recesses of the Works of Nature, and, if possible, to have really accounted for some Things, which, before such Discovery, were judg'd inexplicable.

I have made Use of the Terms, *Fire*, *Electricity*, *electrical Fire*, *electrical Æther*, *aetherial Spirit*, &c. as synonymous.

Sometimes, when speaking of the Conveying or Leading-wire of the Condensing-phial, I have call'd it by that Name; sometimes, the hooked Wire of the Condensing-phial; at other Times, the Wire piercing the Cork of the Condensing-phial, just as they occur'd when I was writing; my chief Aim being, not so much a Compleatness of the Diction, as the Delivering myself in an intelligible Manner.

INTRODUCTION.

*On the several Gradations of the Progress of
ELECTRICITY.*

THE Term *Electricity* explains itself, being deriv'd from *Electron*, which is the Greek Name for Amber, and the Thing is of great Antiquity.

The Ancients, so long ago as the Days of *Pythagoras*, according to some, and very probably long before, were not unacquainted with that Property in Amber, of attracting light Bodies when lying in the Sunshine, but more particularly after rubbing it; perhaps from rubbing an Amber Bead, or the like; for which Reason all other Things, that were afterwards found to be endu'd with the like Qualities of Attraction, &c. were call'd *Electrics*, and all others, *Non-electrics*.

The Reason why Electricity made such flow Advances, in the experimental Way, for so many hundred Years, was, from their not knowing that it escap'd thro' almost all Bodies into the Earth; and more particularly from their not knowing that all such Bodies, which are now call'd *Electrics per se*, were the only Bodies which could prevent such Escape.

Of Bodies which are endu'd with this Quality, Glass is found to be one of the greatest of all, even much to exceed Amber itself; and, when this was discover'd, it might very well be look'd on as no small Improvement; for, when this Power was observ'd

serv'd to be so increas'd, they not only found that it had a Property of Repelling, equal to that of Attracting, but also that it was real Fire.

A still greater Improvement was, the actual Discovery that Glafs, Amber, Resin, Wax, Silk, Hair, and all other electric Bodies, did not convey this electric Matter to other Bodies, nor suffer it to make its Escape thro' them ; for soon after this, it was discover'd, that by supporting a non-electrical Body with Electrics, the electrical Fire could be convey'd instantaneously to any Distance upon any Person, or other non-electric Body thus supported, so that any Part of them should act as powerfully as the Gun-barrel or Tube itself.

These important Discoveries were first made by Mr. *Stephen Gray*, one of the Pensioners belonging to the *Charter-house* ; who spent most of his Time in making electrical Experiments, and who may justly be allow'd, from the great Variety of those made by him, to be the principal Person who set on foot all the late Discoveries and Improvements : Many of his Experiments were communicated to the Royal Society, and were look'd on as such extraordinary Performances, as to merit a Place in the Philosophical Transactions.

It is to his Experiments we are indebted for such clear Hints concerning its Nature and Properties, as to excite numbers of the Curious to pursue the same Clue, and which conducted to such leading Experiments, particularly of its almost instantaneous Motion to the most distant Parts ; he himself having prov'd it to be sensibly instantaneous, to the Distance of 800 Feet.

It was he who discover'd it to make, if possible, its Escape into the Earth ; to prevent which (he having before discover'd, that what are call'd Electrics *per se*, would prevent such Escape) and to cause it to remain on any particular Person, his Method

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Method was to suspend him horizontally on two hair Lines ; then rubbing his glass Tube, and holding it near his Feet, his Face or Hands were instantly capable of attracting and repelling light Bodies.

He also afterwards discover'd, that, if a Person stood on a Cake of Resin, Glass, or any other electrical Substance, it was equally the same as supporting him with hair or silk Lines.

A greater Improvement, yet, was the introducing of the glass Globe, Cylinder, and Spheroid, whirling on their Axis, instead of rubbing the glass Tube ; for by that Means they observ'd the Power increas'd to a very high Degree.

Thus having brought it to such Perfection, a great Number of various Experiments were every where made ; particularly after it was discover'd so plainly to be Fire, as to kindle up many particular Bodies into an actual Flame.

But the greatest Improvement of all, and what conducted to the finishing Stroke, was the accidental and surprising Shock, discover'd to Professor M. de Muschenbroek of Leyden : An Account of which was communicated in a Letter from Paris, and was as follows :

" Mar. 25th, 1746. M. de Muschenbroek, a famous Professor of experimental Physics at Leyden, has wrote a Letter to M. de Reaumur, of the Royal Academy of Sciences, containing an Account of a very singular Experiment, which has led him to several Discoveries concerning Electricity."

The Experiment.

" HAVING suspended an iron Cannon horizontally, upon silken Cords, with one End near the electrical Globe, he fastened to the other End a latten Wire, which descended into

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" a Bottle half full of Water ; that holding up the
" Bottle with one Hand, while the Cannon was
" electrising, he put forth a Finger of his other
" Hand towards the Piece, in order, as usual, to
" draw off a Spark, but was struck such a violent
" Blow, that he thought his Life was at an End ;
" and adds, that, esteeming himself very happy in
" escaping, he had no Mind to repeat the Experi-
" ment, and that the Commotion he felt was like
" a Clap of Thunder.

" As this Letter came at a Time when many
" learned Men were employ'd about Electricity ;
" the Abbé Nollet and M. de Monniers, of the
" same Academy, zealous to search into so extra-
" ordinary a Phænomenon, divested themselves of
" Fear, made the same Experiment as M. de
" Muschenbroek had done, and, in like Manner,
" found the Commotion very terrible." London
Evening Post, April the 1st, 1746. . . .

This sudden and wonderful Discovery amazed the whole *European* World for some Time ; for, before this, very little, if any Power or Force was perceiv'd in it, or even suspected ; so that now it appear'd so much to exceed the Power of what was found in it before, as to bear scarcely any Manner of Proportion ; for instead of being strong enough to be felt to push against the Finger (which, before this, was counted a great Matter) it was then found much more capable of moving a Mountain, and, from the great Number of Experiments which were soon made in all Places, the Progress of its clearer and clearer Discovery was, from that Time, exceedingly rapid.

But, notwithstanding all this wonderful Power was discover'd in it, many were still inclin'd to account for its Production in the old Way, and after the same Manner as when it appear'd in its feeble State, believing it to be emitted by the electrical

Globe :

Globe: And though some of the more Judicious gave it, as their Opinion, to be no other than the Æther of the modern Philosophers, and others, the elementary Fire of the Ancients; these were severely lash'd for it; so greatly are Prejudice, and confirm'd Habits, observ'd to prevail, even with the most ingenious Part of Mankind.

A Description of the Condensing-phial.

THIS Phial, being of the greatest Importance in making electrical Experiments, worthily merits a particular Explanation. Without this, or a like Contrivance, scarce any other Way could have been invented or thought of, capable of entrapping, arresting, and imprisoning this mighty Agent, long enough to make the Experiments.

If this had not been wonderfully reveal'd to us, we had still been ignorant of any great Strength, Power, or Force, in electrical Fire.

The Way and Manner this great Secret was reveal'd to M. de Muschenbroek, was, as before-mention'd, by Means of a Phial partly fill'd with Water; for which Reason all were at first prepar'd in that Manner: *Viz.* A Phial, nearly fill'd with Water, was suspended to the Gun-barrel by a hooked Wire, leading through the Cork to the Water, whereby this invisible Fire was convey'd to it; this Principle, prevailing in the Non-electrical dense Water, immediately conveys it to the Glass, in which the contain'd Æther remains so fix'd, as is not easily remov'd; and with which this electrical Æther appears to be most intimately connected: This is imagin'd to be the Reason it is so strongly attach'd to the Glass, as oftentimes not to return by the Way it came for a long Time afterwards. I once heard an Operator in Electricity affirm he had sent one of these royal Prisoners, thus confin'd, near a Mile, which afterwards burst through, both

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his Prison and Keeper, giving him a Blow on the Elbows at Parting.

Mr. *Rackstrow*, in *Fleet-street*, kept this Fire in a Phial, with Water, for ten Hours, and others, a longer Time, but Mr. *Monniers* kept it so for thirty-six Hours ; and every Operator in Electricity very well knows that this pure Fire may be kept in close Connexion with Water for a long Time, particularly if the Water be made and kept warm.

The more dense the Fluid contain'd in the Phial, the more Power there appear'd of holding it together ; for, when it was furnish'd with Mercury, instead of Water, so much was oftentimes detain'd as to burst of its own Accord.

Afterwards, the common Method, in forming those electrical Magazines, was to make Use of brass or iron Filings, instead of Liquids, and coat the Outside of the Phial with a thin Plate of Lead ; which was found to be still better.

But the most commodious Way is to line the Inside of the Phial with Gold-leaf, &c. and to coat it with Tinfoil, thin Lead, or the like, and to fasten some Tinsel-fringe to the Bottom, or the End of the Wire within the Phial, so as to reach to the gold Lining, by which Means the electrical Fire is convey'd to it.

It is not very material what Form the Glass is of ; to prove which, and to shew the exceeding great Power of this Fire, when more is collected, by enlarging the Glass, I shall mention what Mr. *Rackstrow* says, after he had been giving his Opinion of the Way and Manner in which he conceiv'd Lightning and Thunder to be generated :

“ I shall now endeavour farther to shew the Similarity of Thunder and Lightning to Electricity. The surprising violent Shock that is to be given, even in a Degree greater than they can

“ well

" well bear, to any Number of Persons at once,
 " is sufficient to satisfy us, that the Electricity, pas-
 " sing through a Tree in the same Manner, must
 " shock the Solids thereof, as it does the Animal
 " Body. If we could collect a great deal more E-
 " lectricity, we might split the Tree, as we burst
 " the Vessels in Animals kill'd by Electricity ;
 " whose Bodies look livid, as when killed by
 " Lightning.

" Mr. *Watson* communicated the following Ex-
 " periment to me, and shew'd me such a large
 " Glass as I am about to describe ; but his was
 " broke. He took the Hint from Dr. *Bevis*, who,
 " for the same Experiment, made Use of a flat
 " Glass, gilt on both Sides, excepting a Margin
 " round, no Matter what Form. This Glass,
 " that was shewn me, was blown very thin, in the
 " Shape of a Cylinder, like a Confectioner's, open
 " at Top, and gilt both on the Inside and Outside
 " to within two Inches of the Top. I cover'd
 " mine, which was about twenty Inches high, and
 " ten Diameter, with gilt Leather, as high as it
 " was gilt ; which preserv'd it from breaking, and
 " made it act the stronger. The Metal within such
 " a Glass as I have describ'd, when electrified, will
 " act with greater Vigour than 25,000 Times its
 " own Weight of iron File-dust in Bottles electri-
 " fied ; which proves that it is from the Number
 " of the Points in Contact that it comes to act so
 " strongly, and not from the Quantity of the Me-
 " tal. I let a Piece of Chain hang down from the
 " Tube which I had electrified, to electrify the
 " Metal within the Glass ; I made Use of another
 " Piece of Chain, about ten Yards long ; one
 " End of which I laid under the Bottom of the
 " Glass, and the other End I held to the Tube
 " electrified, to cause the Explosion, which was as
 " loud as the Report of a Pistol, and the Flash of

“ Light so very bright, as to dazzle the Eyes of the
“ Beholders ; the whole Chain that led the electri-
“ cal Explosion was not only illuminated, but
“ darted Fire in most Directions ; the Report,
“ though as loud as that of a Pistol, was not so
“ short, but more like that of Thunder. The first
“ Time I tried this Experiment, I thought it had
“ broken the Glass to Pieces. In Places where
“ the Chain communicated, I have in a proper
“ Manner, in one Place, put warm Spirits of
“ Wine, in another File-dust, Vitriol, and Water
“ mixed together, some Oil of Turpentine in a
“ Third; and, in trying the above Experiment, all
“ these different Things would take Fire together;
“ which is a Proof, that Electricity is capable of
“ setting Fire to all sulphureous Exhalations or Va-
“ pours in the Air ; and, those combustible Clouds
“ taking Fire one after the other, their different
“ Explosions cause the successive Noise of Thun-
“ der.” Mr. Rackstraw’s *Essay*, p. 65.

A short



A short Introductory
DIALOGUE
ON THE
NATURE and PROPERTY
OF
Electrics and Non-Electrics.

B.  **H**AT must we suppose to be the Cause of those remarkable Qualities, so different in different Bodies, termed original Electrics, and Non-electrics ; or, as they are now term'd, Electrics *per se*, and Non-electrics? And what Kind of Bodies are the most remarkably so?

A. The circumambient Atmosphere is observ'd to be one of the most remarkable of all original Electrics, and the Body of the Earth as remarkable and powerful a Non-electric.— But of these farther on.

B. I should be glad to be inform'd in what Manner the electrical Fire is suppos'd to be conducted by these Non-electrics ?

A. These

A. These Conducters, as they are called, are such Bodies only, in whose Pores, the original Æther stands so loose as well as rare, as to be freely driven on by the first Impulse; and thus makes Room for the Flux, of this newly collected electrical Æther, which pressing, by accumulating on it, drives it forward, and then possesses its Place, and may be reasonably suppos'd to execute the same Office; and, as this will constantly and invariably appear to be the Case, I shall make Use of no more Words to explain it, till I come to the Experiment which proves it.

B. What is thought to be the Cause of that particular Quality in those Bodies, termed Electrics *per se*?

A. Electrics *per se* are such Bodies, in which the original Æther seems to be more fix'd, and, consequently, cannot move freely on, to make Room for the newly collected electrical Æther to take Place, as in the former Case: The most probable Conjecture for its Prevalency, and what seems most agreeable to Reason and Observation, is, from a particular inherent Texture of the Parts of such Bodies, saturated, no doubt, with this Principle, in the first Formation; of which, among Animals, the *Torpedo* or numbing Fish is accounted, by many, the most remarkable, and the sensitive Plant among Vegetables.

But the most compleat of any, of such Bodies, seem to be those form'd of the minutest Particles or Effluvia of Bodies; which minute Particles incorporate as it were, or adhere in so remarkable a Manner to the æthereal Particles, that they are not easily disunited, but by the Action of the electrical Machine; or else otherwise greatly agitated: A Quantity of these, when form'd into one Mass, are observ'd, in the Experiments, to be the most remarkable.

Of

Of this Sort is the common Air, which appears to be such a Mixture of this Æther, and the earthy Exhalations adhering and uniting so firmly with it, as to be perhaps the greatest Electric *per se* of any Thing in Nature ; for, though a small Part of this Fire seems to be separated from, and collected out of the common Air, yet it shews the utmost Reluctance towards Returning into it again, and as we shall soon find as great a Propensity to return into the Earth, after being conducted to the Gun-barrel, or any other Non-electric, supported with original Electrics ; so that the Air, particularly a dry Air, seems so saturated with it as scarce capable of receiving more.

B. What other Bodies are the most remarkable Electrics ?

A. All unctuous inflammable Bodies, in general, appear to be saturated with this Fire, and also fix'd as abovemention'd : And of inflammable Substances those of the fragile Kind, and such as break with a Polish, seem to possess this Quality the most ; as Resin, Pitch, Sealing-wax, &c. Sulphur also, and Bees-wax, though they do not break with such a Polish as the rest, yet are they very remarkable Electrics, particularly the Former.

Also Glass, Amber, and some other hard brittle Bodies, although not of an inflammable Quality, are yet the most noted in the whole Class of Electrics ; they are therefore in all Probability saturated beyond other Bodies with this Fire, which remains also fix'd.

And, lastly, there is yet another Kind of Electrics *per se*, of a more soft Texture ; such as Silk, and the Hair of many particular Animals ; also many Insects, as Bees, Flies, Moths, &c. besides many other animal Substances, when dry.

Two chief Reasons why such soft Bodies as Silk, the Hair of Cats, &c. are such remarkable Electrics,

trics, are most probably ; first, that they are saturated with this Principle in their Formation, and also fix'd as above ; secondly, being of so loose a Texture, their Pores or Interstices are so large, as to admit of the common Air, which is always observ'd to be the greatest Impediment to the Motion of the pure Æther ; and this seems to be confirm'd, by observing how, when their Pores are fill'd up, by soaking them in Water, they are at once converted into vigorous Non-electrics ; so that here, as the dense Water, whose Pores are so small as not to admit the coarser Æther, or Air, but the finer Æther only, the Whole, to Appearance, is become a Non-electric ; but, as this can in no wise alter the Nature of the Body itself, so it can be no other than a proper Vehicle which admits of the finer Æther only, wherein the inconceivable Strength and Energy lies.

For the like Reason, many Vegetables, which, when green, and replete with Juices, appear to be very powerful Non-electrics ; yet that Power, as they become more dry, is found more and more feeble, particularly those which are of the most light and loose Texture ; and in Cork very little, if any of that Quality remains, though no doubt but that too, like other Vegetables, when green and full of Sap, was as great a Non-electric as the rest.— It appears then, that, if the Æther be fix'd in the Body, it then must constitute an Electric ; if not fix'd, then a Non-electric.

B. But why do you not rather imagine that such Bodies as Amber, Glass, Resin, Sulphur, &c. being so saturated with this electrical Fire, is the Cause of our Seeing it thrown out in such Plenty in the same Manner as has been imagin'd ?

A. Because, were it so, and if the Glass could easily part with it, like a Non-electric Body, there would be no electrical Fire produc'd from it, any

more than from a Globe of Metal ; it must be own'd, *that* was the common Way, at first, of accounting for its Production ; and that the electric Matter, inherent in the glass Globe, was put into such a vibrating Motion by the Attrition of the Hand or Cushion on the Outside of it, while in Motion, as to be thrown out thereby in so copious a Manner ; but this Way of accounting for its Production, not agreeing with Experience, was therefore exploded : That the Æther is really fix'd in them, beyond what it is in other Bodies, so as not to suffer the newly collected Æther to move through them so freely as through Non-electrics, may be prov'd by Numbers of Experiments,—and if the circulating Experiment, *viz.* Experiment the IVth, be attempted, and the Circuit be divided in any Part by the Interposition of the least Piece of Glass, it will not succeed.

And though these Particles of Æther contain'd in Glass, Amber, &c. seem so fix'd as not easily to be mov'd out ; yet does it appear capable of being agitated and put in Motion, even by the ignited Æther or solar Rays only, so as to act at some Distance from the electrical Body ; it being observ'd that a glass Tube, having only been so long expos'd to the Sun, as to acquire a small Degree of Warmth, will attract light Bodies.

Note. What is here call'd Attraction is conceiv'd by many to be perform'd rather by Pressure, thus :

When the Power or Force of the excited electrical Body is extended to any Distance from the Body ; all Parts contain'd within that Distance, are by the Action of the Æther become more rare than the Parts surrounding it ; by which Means the grosser Air, pressing to restore the Balance, drives those light Bodies towards it.

DIALOGUE II.

B. **H**OW came it to be first known, that such a subtil Medium actually existed ?

A. By its Effects only, before it was more clearly prov'd by Means of Electricity.

B. Can it seem credible that there should be no other Means of discovering it, notwithstanding it was describ'd with most of its great and essential Qualities ?

A. However incredible it may seem, yet nothing is more sure ; for no such Agent could ever be demonstrated to the Senses, till it was perform'd by Means of electrical Experiments.

B. Who was the first Discoverer of the Existence of such a subtil Medium in Nature, and how long since the first Discovery ?

A. It is something uncertain who was the first Discoverer, but we are assur'd from History, that it was known by the ancient Philosophers, some thousand Years ago, who not only discover'd the most essential Properties ascrib'd to Æther by all the greatest Philosophers ever since, but they also discover'd it to be an invisible Fire ; all which agrees with this electrical subtil Medium.

They also pronounc'd it an Element, which is now the Opinion of many Moderns likewise, particularly since the late great Improvements in Electricity.

The Ancients not only thought themselves sure of the Existence of such an universal subtil Medium, but they also ascrib'd to it the greatest Power and Efficacy ; for, according to those Philosophers, it was the most necessary mechanical Agent of all created Beings.

The Æther of *Des Cartes* was his *Materia subtilis*, or his first Element ; by which he understood

stood a "most subtil Matter very swiftly agitated; " fluid, and keeps to no certain Figure, but which "suits itself to the Figure of those Bodies that are "about it.

" His second Element consists of small Globules ; that is, Bodies exactly round and very solid, which do not only, like the first Element, fill up the Pores of Bodies, but also constitute the purest Substance of the Æther and Heaven." Blome's *Translat. of Des Cartes's Philos.* p. 101.

Æther, according to Sir Isaac Newton, is a thin subtil Matter, much finer and rarer than Air.

Sometimes term'd a subtil Spirit, as in the latter End of his *Principia*; and sometimes a subtil æthereal Medium, as in his *Optics*.

To say the Truth, there were Abundance of Considerations, which seem'd to evince the Existence of some Matter in the Air, much finer than the Air itself; and an unknown something always remain'd behind, when the Air was taken away, as appear'd from certain Effects which were produc'd in *Vacuo*.

This Æther was suppos'd to be universally dispers'd, so as to fill up all the Parts of Space, even all that Space, which is, by some others, term'd the immense Void ; and not only so, but all the Interstices or minutest Pores of the most dense and compacted Bodies.

" The Existence of such an universal æthereal Medium being settled, Sir Isaac Newton proceeds to its Properties, inferring it to be not only rarer and more fluid than Air, but exceedingly more elastic and active : In Virtue of which Properties he shews that a great Part of the Phænomena of Nature may be produc'd by it, as Gravitation, &c. to its Elasticity he attributes the elastic Force of the Air, and of nervous Fibres, and the Emission, Refraction,

“ Reflexion, and other Phænomena of Light ;
 “ as also Sensation, muscular Motion, &c. In
 “ Fine, this same Matter seems the *Primum Mō-*
 “ *bile*, the first Source or Spring of physical
 “ Action in the modern System.” *Chambers's Dictionary.*

At the End of the *Principia*, Sir Isaac Newton speaks of a most subtil Matter, which, he says, pervades, and lies hid in all gross Bodies ; by the Force and Action of which Spirit, the Particles of Bodies mutually attract one another at small Distances, and cohere when in Contact ; and electric Bodies operate at greater Distances, as well by repelling as attracting the neighbouring Corpuscles ; and Light is emitted, reflected, refracted, inflected, and heats Bodies, and all Sensation is excited, and the Members of animal Bodies move, at the Command of the Will, namely, by the Vibrations of this Spirit, mutually propagated along the solid Filaments of the Nerves, from the outward Organs of Sense to the Brain, and from the Brain into the Muscles : But, says he, these are Things that can't be explain'd in few Words ; nor are we furnish'd with that Sufficiency of Experiments, which is requir'd to an accurate Determination and Demonstration of the Laws, by which this electric and elastic Spirit operates.” Thus accounting for that otherwise unaccountable Phænomenon, animal Motion.

Quæry. Whether we may not most reasonably conclude,

The elementary Fire of the Ancients,
 The *Materia subtilis* of *Des Cartes*,
 The Æther, or elastic subtil Medium of Sir Isaac Newton, and
 The remarkable Phænomenon, electrical Fire
 (just

just discover'd *, to be one and the same subtil Substance :—Particularly, as we can observe such a remarkable Agreement, Similarity, and Coincidence among the several suppos'd subtil Mediums.

That it should be reasonable to suppose electrical Fire to be that very identical subtil Substance, or Medium, can't well be doubted, since all the most essential Properties which they ascrib'd to their elementary Fire, Æther, or expansive subtil Fluid or Medium, are found in electrical Æther, and that also in the utmost Degree of Perfection.

B. How do you prove the electrical Matter to be endu'd with those essential Properties ?

A. By the most convincing Experiments : But I shall not dwell on a long Series of Experiments, for if the invisible, expansive, subtil Medium, which has been so long suppos'd, and so clearly explain'd by Sir Isaac Newton, is, or is not, that very identical Substance, which is now render'd visible, and realiz'd to the other Senses, and of which we have such effectual Means put into our Hands to examine it by, insomuch that we can't easily mistake its Nature and Properties ; a few capital Experiments must necessarily be abundantly sufficient to determine it : For, if we can produce one such powerful, elastic Æther, or subtil Medium in Nature, as he has describ'd, and endu'd with such other surprising Properties as he has ascrib'd to his Æther, it is presum'd there can't be left much Room for Doubt or Hesitation ; because none will expect to find, at the same Time, two such universal, expansive, attracting, repelling, inconceivably swift, and powerful, subtil, fluid Mediums in Nature, form'd so exactly alike, as

* The complete Discovery of Electricity is suppos'd to take Date at the Discovery of the Shock.

that one can't be distinguish'd from the other. Again,

None will expect to find unerring frugal Nature grown all at once profuse, as it must undeniably be, and that too in the most superlative Degree, if this could be prov'd ; and, every one would allow, ought justly to be chronicled, as the first Time it was ever known to be so.

B. But how will the greatest Objection, brought against those kind of Arguments to prove a subtil Medium, be remov'd ; namely, such as this : Can it be thought probable, not to say possible, that the most stupendious and most powerful mechanical Agent in Nature, as the subtil Medium of Philosophers is allow'd to be by the very greatest of them, even capable of being the first and only instrumental Cause of the greatest Operations we behold in it ; I say, can it be suppos'd reasonable, that so mighty an Agent should be so clearly discover'd, by so simple a Method as the electrical Machine ?

A. But, since we are capable of discovering such a powerful subtil Medium by that simple Method, what Reason have we for quarrelling with the Method ; for, as all Things are alike easy to the great Revealer of Secrets, have we Reason to be out of Humour, merely because his Method of discovering it to us is easy and plain ?

Can such Objections be really just ? Are they not indeed most ridiculous ? What can be said for Men, when we find them thus quarrelling with the only Method that was ever found capable of discovering any such powerful subtil Medium ? For,

Was it ever clearly prov'd before ? Was not all that was affirm'd by those Philosophers, concerning it, mere Conjecture ?

Whereas, by Means of electrical Experiments, we are as sure that such a Medium really exists, as

we are of any one Thing of which the Senses can inform us—nor can the Exposing such a Method of Reasoning be derogatory or injurious to the illustrious Characters of those eminent Philosophers, who, we are sure, were far from being mistaken, in the Thing itself, by our finding them so constantly describing it, with all the great and essential Qualities which we actually behold in it, now it is so plainly discover'd; but the very greatest of them, even the great Sir Isaac Newton himself, never pretended to prove the Certainty of its Existence otherwise than by its Effects.

And, notwithstanding his ardent Desire to find it out, and his many sagacious Experiments to prove it, yet none could be thought of, or invented, that were sufficient to make a clear Discovery: One of those inquisitive Experiments we find in his Optics, Quær. the 18th—and, although he infers very largely from the Premisses, yet is he far from giving his Opinion, whether it was an invisible Fire, or not, but frankly owns he does not know what it is, Quær. 21.

How the ancient Sages were furnish'd with Hints sufficient to discover it to be an invisible, pure Fire, is not easily to be conceiv'd, notwithstanding they describ'd it so very exactly.

B. How is the electrical Fire immediately produc'd?

A. Out of the Earth and Air, but particularly the former.

EXPERIMENT I.

Tending to point out the Source, or main Spring, from whence it is deriv'd.

If a Person, standing on the Floor, lays his Hand on the glass Globe in Motion, the electrical Matter is produc'd in great Plenty, as we

find by its Acting so vigorously on the Gun-barrel, or other Apparatus of Wires ; but if he steps on a Cake of Resin, &c. it is very much weaken'd, and very little Fire or Attraction is to be found on the same, notwithstanding the Friction be continu'd at the glass Globe * : To prove that this is no Deception, let him put a Foot again to the Floor, and they will that Instant act vigorously as before, and be again as instantly depriv'd of that Power at Lifting it up again, and *vice versa*.

B. But if this subtil Agent can be so plainly prov'd to be produc'd from the Earth, it would be but natural to find in it as perpetual a Tendency to escape into it again ; which if you can also prove, it will be a farther Confirmation of your Assertion and Experiment.

A. Nothing can be much easier prov'd ; for which Reason, and to shew likewise, that a few capital Experiments will, as above, be sufficient for my Purpose, I shall produce a single one, which alone proves the electric Matter to be endu'd with a most surprising Subtilty and an inconceivable Velocity ; and which also proves or greatly illustrates the Doctrine of Sir Isaac Newton, *viz.* that this subtil Medium is contain'd in all dense Bodies : Also, that in dense non-electrical Bodies it will, upon the first Impulse of the electrical Matter, rush out and give Place to it, to occupy the same Space, and may be reasonably presum'd to execute the same Office.

Also, that the Air, particularly a dry Air, appears to be one of the greatest of Electrics *per se*, and the Body of the Earth, the most complete Non-electric.

* The small remaining Part on the Apparatus is supposed to be supplied by the Air.

EXPERIMENT II.

Electricity unveil'd, or an Experiment tending to prove what it really is; also its great Inclination to return into the Earth from whence it came.

IF Wires are supported with silken Strings to any given Length whatsoever, and then electrish'd; although they will shew as great an Energy, and produce as smart a Crack, or Explosion, at the greatest Extremity as near the Machine, particularly if the Air and silk Supporters are very dry, yet, if they are touch'd but with a Finger of a Person standing on the Floor, at the same, or any other Distance, the whole Length of the Wire will be, that Moment, depriv'd of its electrical Virtue, and not the least Sign of Fire or Attraction will be found at any Part of the Apparatus, and will be again as instantaneously restor'd to its former Activity by taking off the Finger.

What Experiment can possibly prove any Thing more effectually than this does that of extreme Subtilty and inconceivable Velocity?

For although when a Finger is on, even at the farther End, no Fire or Attraction is to be found throughout the Whole, yet it must, at the same Time, be undeniably passing through the internal Parts of the Wires, and through the Person into the Earth, otherwise it could not again so instantaneously accumulate and form an Atmosphere on them, at Removing the Finger: Or if, instead of removing the Finger, he steps upon a Cake of Resin or Bees-wax, the Effect will be the same; and again, if he but touch the Floor with one of the Toes of his Shoes, while standing on the Resin, and a Finger on the Wire, the Whole will again, that

very Instant, be depriv'd of its Activity, and so continue as long as he either keeps his Foot on the Floor, or if but touch a Person with a Finger of the Hand at Liberty.

Q U A E R I E S.

DOES not the Air, in this Experiment, act the Part of an Electric *per se*, and that in a most remarkable Manner? Were it not so, in all Probability, there never could have been the least Appearance of what is call'd Electricity; it must necessarily vanish into it again, as soon as excited, notwithstanding the contiguous Wires and silk Supporters; but, instead of that, does it not cling and accumulate on the Wire, as we find by its Attracting light Bodies; forming an Atmosphere to a considerable Distance from the envelop'd non-electric Body, rather than depart again into the heterogeneous Mass, from whence * Part of it seems just collected; and will it not, as it were, suffer itself to be taken Captive in the Condensing-phial, rather than return thither again?

And does it not seem to have as great a Propensity to escape into the Body of the Earth, as a Reluctance towards Returning into the Air? Does it not, at the Touch of a Finger, &c. though at the greatest Distance, dart, that Moment, into the Earth, through the Person and all the intermediate Wires; or if, by this or any other Means, these Wires are brought in Contact with any Non-electric which has a Communication with the

* Although the principal Part of the electrical Æther is so undeniably attracted from the dense Non-electrics near the Glass, and supply'd from the Earth; yet, in all Probability, a small Portion likewise is rubb'd or ground out of the Air, as no small Quantity of Air must necessarily pass between the Hand and revolving Globe.

Earth, the Effect is always the same, and not the least Sign of Fire or Attraction is to be found on any Part of the Apparatus.

Does not the original Æther, in this Experiment, quit the internal Parts of the Wires, and give Place to the newly collected Æther or electrical Fire, to enter and occupy the same Space ; and, consequently, execute the same Office, which it must necessarily do, all the Time the Wire has this suppos'd Communication with the Earth, and the Machine in Motion ; and does it not, as it were, leap into the Earth through the Person and the internal Parts of the Wires so instantaneously as not to allow Time sufficient to accumulate or form any Manner of Atmosphere on the external Parts ? For, if the smallest Degree of Accumulation were on the external Parts, some small Degree of Attraction would be also found, which yet is not the Case.

Does not the electrical Fire as effectually pass from the Machine, through the internal Part of the Wire, and through the Person into the Earth, as surely as Water is convey'd through a Pipe, all the Time the Machine is in Motion, and the Person with his Finger on the Wire ; and is not this Communication with the Earth as effectually separated by his Stepping on the electrical Cake, since the whole Line that Moment acts vigorously ? What much adds to the marvellous Part, is, that the Wires being touch'd, though at the greatest Distance, should so affect it, as to put an entire Stop to the Appearance of either Fire or Attraction throughout the whole Length of the Line, as effectually as if done ever so near the Machine.

Upon the Whole, if this Experiment alone is not allow'd to be conclusive, I should be very glad to be inform'd of the Reason why ; particularly if we are to suppose, with Sir Isaac Newton, that the

Pores of the Wire were replete with the Particles of Æther, before the Machine was in Motion : If the electrical Fire were not actually the same Substance with the Æther, why would the original Æther in the Wire be found so naturally to rush out first into the Earth, and give Place to the electrical Æther to follow it ? For it is imagin'd it will not be reply'd, there was Room enough in the Wire for both, or for the electrical Fire to pass by the Side of the original Æther, contain'd in the internal Parts of the Wire.

N. B. I have insisted the more on this Experiment, because, though it is most easily perform'd, yet no Experiment can well be more clear and conclusive, or prove any Thing more effectually than this does, that they are one and the same.

B. But although the original Æther in Animals, Metals, &c. appears so naturally to move out at the first Impulse of the electrical Æther, and resign its Place and Office at once ; yet, surely, it can be no absolute Proof that they are the very same Substance ; because we know Water will drive Air out of a Cask, Tube, or Pipe, and then possess the same Space ; yet, no-body will affirm that Water and Air must for this Reason be the same Substance.

A. This would appear like a formidable Objection indeed, if Water was so much like Air, that one could not be distinguish'd from the other, and endu'd with the most essential Properties ascrib'd to Air ; but, if not, it can be but of little Weight, nor can any Arguments to prove the Contrary be admitted, but such as are equally strong, and supported with Experiments equally clear and conclusive ; this being what is expected in all other Cases, it will be thought but reasonable, that the present Case should rest where the present Arguments and Experi-

Experiments leave it, till such equal Arguments and Experiments are produc'd against it.

B. But how can it be known that this subtil Substance is passing, as you say, through the *internal* Parts of the Wire, in the above Experiment, all the Time the Person on the Floor keeps his Finger on the Wire? Why may it not be more reasonably suppos'd to pass along the Surface?

A. Not only because there is no Fire or Attraction to be found throughout the Surface of the whole electrify'd Line, but many other Experiments so clearly prove it to pass through the internal Parts of Bodies, as to put it beyond Dispute, such as the Experiment of the capillary Syphon, and many others.

In the Experiment of the capillary Syphon, for Example, it must necessarily pervade the whole Body of the Water, before it can come to the lower End of the Syphon at the Bottom of a glass Cup: I have also prov'd it, through a glass Vessel of Water, twenty-seven Inches in Length: Also by bringing a Chain from the condensing Phial to the Cock of an upright Barrel of Liquor, then putting a Finger to the Liquor at the Bung, in the Top, and bringing a Finger of the other Hand to the excited Apparatus; the electrical Æther was observ'd to pass through it most freely, because a smart Shock was felt as usual in the Elbows.

In the preceding second Experiment appears something most wonderful.

The ætherial Spirit, or subtil Medium, is not only undeniably found to possess and fill up the Pores of the dense Wire, where it is consequently exceeding fine and rare; but it appears also quite loose and free, and so active as to quit its Place at the very first Impulse of the electrical Æther at the Machine, notwithstanding the Machine be at ever so great a Distance from the Part where the Wire

communicates with the Earth ; and though the metallic Tube, for so I can't help calling the Wire, with Regard to the moving Æther, be ever so often turned and returned, and ever so many Angles form'd *.

Let us then once more, for the Sake of Illustration, suppose a Wire, of some thousand Miles in Length, supported as above with silken Strings ; from any Thing that appears to the Contrary, we can have no Reason to believe but that the Effect would be, to Sense at least, equally the same as if it were no more than so many Inches or Barley-corns in Length.

Or, instead of such a Length of Wire, let a Number of Men continu'd to the same Length be suppos'd standing on Cakes of Resin, all joining Hands, or communicating with each other by Means of metallic Bodies, yet still the Effect must be the same ; and if the Person, at the utmost Extremity, were but to put his iron Rod to the Earth, or put a Foot on it, the whole Length will that Moment be (as prov'd above) depriv'd of its Fire and Attraction, even quite to the very Machine itself ; and the former Activity as instantaneously restor'd throughout the Whole, at Lifting up of the Foot or iron Rod, particularly if the Air be suppos'd perfectly dry.

B. How is it possible to account for such an amazing Paradox ?

A. No otherwise than by conceiving its Motion to be perform'd in the same Manner as the solar Rays, ignited Æther, or Light ; which by Means of an astonishing Elasticity, their Motion is pro-

* This is such a Property belonging to electrical Æther, which, before it was discover'd by electrical Experiments, was scarce ever imagin'd to belong to any Kind of subtil Fluid in Nature.

pagated or reflected to the Distance of ten Millions of Miles in a Minute ; *viz.* by conceiving each elastic Particle to drive the next Particle forwards in the very same Manner as Solids do.

And, notwithstanding the Velocity of Light is so great, yet is there no less Reason to conclude, from the Experiment, but that the Motion of the electrical Æther is equally instantaneous, from the electrical revolving Globe, into the Earth,

N. B. It is to be observ'd, that by the two foregoing Experiments a Circulation is perform'd, although we seem quite ignorant of it, as well as many other Kind of Circulations in Nature, of which those Experiments furnish us with various Hints.

By the first Experiment we plainly perceive it to be supply'd from the Earth, through the Instrument of Friction to the prime electrical revolving Globe, where the violent Force of Attraction is form'd : And by the second Experiment we as plainly perceive it to return from the Globe to the Wires, and through the Person into the Earth again.

So that if a Person, with a Hand on the Globe in Motion, touch any Part of the excited Apparatus with his other Hand, a Circulation of the electrical Æther is perform'd through him at the same Time ; *viz.* attracted by the glass Globe from his Hand and Body, and supply'd by the Earth ; and back from the Apparatus, through the other Hand into the Earth again.

B. Sir Isaac Newton frequently makes Mention of a violent rapid vibrating Motion in his Æther, which communicates Motion to other Bodies.

So that, by its Pulses or Vibrations, he accounts for many of the Operations of Nature.

And even that of Sensation is said to be perform'd by the Vibrations of this subtil Spirit pro-

pagated

pagated along the solid Filaments of the Nerves, begun by external Objects, and convey'd to the Brain.

The different Sorts of Rays of Light also he conceives to make Vibrations of different Bignesses; which, according to their different Size, excite Sensations of different Colours; much after the same Manner as Vibrations of the Air, according to their different Bigness, excite Sensations of several Sounds*.

I should be glad therefore to know if you have any Experiment which proves such a vibratory Motion in electrical Æther?

A. There is one in particular that appears very much to illustrate such a Supposition, which Experiment seems to be perform'd by Means likewise of a violent elastic Force †, inherent in the electrical Æther, and is as follows:

EXPERIMENT III.

IF a downy Feather, or a Piece of Thistle-down, be laid near the Edge of a smooth Plate of Metal, and brought to the Distance of two Inches, more or less, of the excited Gun-barrel or Wires, &c. which proper Distance by Trials is soon found, laying a Finger, at the same Time, on the excited Apparatus, till it be brought to a proper Distance; the Feather will, at Taking off the Finger, be attracted and repell'd with such an astonishing Celebrity, that we even lose Sight of it, both as to its Form and Motion; and all that will be discern'd, is its Colour only ‡, which fills up the whole Space in which it vibrates; for which Reason it is impossible to form any tolerable Conjecture or Computation of the Number of Vibrations per-

* Chambers's Dictionary.

† Sir Isaac Newton, when speaking of Æther, says: That the elastic Force of this Medium is exceeding great, may be gather'd from the Swiftness of its Vibrations. Opt. Quær. 21.

‡ This is not to be seen in Perfection, except the Machine acts vigorously.

form'd, which possibly may be some Thousands in the Space of a Minute, so inconceivably swift is its Motion: If the Piece of Metal be held ever so little farther off, the Motion will be much retarded; but if it be brought nearer, or to about an Inch and an Half of the electris'd Body, it makes a full Stop all at once; it then communicating the Fire as fast to the Non-electris'd, as it receives it from the electris'd Metal; but the proper Distance is sometimes greater, sometimes less, according to the Size of the Thistle-down *.

B. What do you infer from this vibrating Motion, as you call it, of the Feather which is thus mov'd backward and forward like a Shuttle-cock, by the attracting and repelling Quality of the electrical Matter? Can this Motion of the Feather shew a vibrating Property in the electrical Matter? This seems to prove no more than what is generally allow'd, namely, that, where Attraction ends, Repulsion begins.

A. But the Reason, why an equal Repulsion should begin where Attraction ends, does not appear quite plain: We are told that a Body which receives an Impression, but does not retain it, is call'd an elastic Body, and,

If the Force of Restitution be equal to the Force of Compression, it is said to be perfectly elastic.

Here seems indeed to be a Reason pointed out, why it may be expected, that, where the repulsive Power ends, there an attractive Power, or a Power in the opposite Direction, should begin; namely, the different and alternate Motions of an active elastic Agent; or, to speak more intelligibly, where the Force of Pulsion or Compression ends,

* In this Experiment the Feather is oftentimes observ'd to move circularly when brought to a little farther Distance, viz. where the Motion is more slow.

there the Force of Restitution, or what is otherwise often call'd Attraction, begins ; and electrical Experiments furnish us with various Hints, which seem to countenance an Hypothesis, even of a perfect elastic Quality in Æther : Sir Isaac Newton himself supposes it to be 700,000 Times more elastic than Air, and 700,000 more rare, in his *Optics, Quæries 21 and 22* *.

Quæry I. If the Supposition of such a perfect Elasticity in the ætherial Medium be not agreeable to the constant vibrating Motion which it is suppos'd to be endu'd with ?

On the Supposition of such a universal vibratory Motion throughout Nature, and of complete Elasticity in the Parts of the universal Æther.

Quæry II. Whether it is not arguing consistently to say (instead of saying, where Attraction ends, there a repulsive Force begins) where Repulsion or Compression ends, there an equal Power of Elasticity or Restitution must consequently begin ? Since, by such a Supposition, a universal mechanical Motion, when once begun, must be perpetuated ? All which appears, likewise, not only agreeable to the above suppos'd constant Vibration of the Parts of Æther, but simple, and therefore so much the more like Nature ; agreeable also to the Opinion of the renown'd Boerhaave, viz. that Fire is the Cause of all the Motion in the Universe.

B. Which is the chief or most prevailing Property in electrical Æther ?

A. The Properties are so numerous, and withal so remarkably great, it is something difficult to determine which is the Chief ; but, when it is arrested

* Sir Isaac Newton says, the elastic Force of the Æther must be more than 490,000,000,000 Times greater, in Proportion to its Density, than the elastic Force of the Air is, in Proportion to its Density. *Optics, Quær. 21.*

and detain'd in the Phial, the most prevailing Quality appears to be a Tendency to circulate, which is always remarkably conspicuous, whenever a Shock, as it is call'd, is produc'd, which Circulation is observ'd to be perform'd from the charg'd Condensing-phial to the same Place again; and, whatever be the Form of the Circuit, the Result will still be the same, nor can any Shock be given, except a Circuit of some Form or other be contriv'd, from the Body of the Phial to the Leading-wire; viz. the Wire which enters into the Phial, or else to some Non-electric in Contact with it, as the Gun-barrel, &c. on which it is generally suspended.

But it is by no Means necessary that the Phial be suspended on any Part of the Apparatus, for a Shock may as easily, and many Times much more comodiously, be given by holding it in the Hand.

E X P E R I M E N T IV.

In which appears the most remarkable, elastic, or violent expansive Force that can possibly be conceiv'd, and which may not improperly be term'd the circulating Experiment.

IN Order to explain this Phænomenon the more clearly, I shall first take Notice of the shortest Circuit of all, which may be perform'd thus:

Lay the hooked Leading-wire, piercing the Cork of the Condensing-phial, either to the glass Globe in Motion, or else to the excited Gun-barrel or Wires, by which Means it will soon be sufficiently charg'd; which done, put one End of any metallic Body to the Coating of the Phial, and then bring the other End to the Wire which conveys the Fire into it, through the Cork, where it will burst and produce a smart Crack or Explosion, but the Person who makes the Experiment will receive

receive no Shock ; the Reason of which is, the constant Rule it observes, in always passing the nearest and shortest Way possible, which in this Experiment is through the connecting Wire, or that which comes from the leaden Case of the Phial, to the Wire passing through the Cork.

In this shortest Circuit, the most Fire and the greatest Explosion is produc'd * ; and those Effects are, as may reasonably be suppos'd, according to the Size of the glass Vessel prepar'd for its Reception.

B. How can you be sure that any Circulation is perform'd in this Experiment, by only seeing it burst at the Meeting of the two Wires ?

A. To prove that there will always be a Circuit form'd in this Experiment, and that from the Part where it is generated to the same Part again, *viz.* from the Inside of the Phial to the Inside of the same Phial again : Let the Circuit be enlarg'd, thus :

Instead of bringing the connecting Wire from the Coating of the Phial to the Wire leading into it, as in the last Experiment ; let a Person grasp the charg'd Phial, and bring a Finger of his other Hand to the Wire which leads through the Cork, at which Place it will crack or explode as before ; but, in this Experiment, the Person receives a Shock, particularly at his Elbows or Wrists ; for, as the greatest Part of this Circuit was form'd by the Person, the nearest Way it could circulate must be through his Arms and Breast, which being perform'd with the utmost Violence, is the Reason why those Parts are so affected, particularly the Elbows or Wrists, where it meets with the greatest Resistance.

* The Explosion is very small when the Circuit is large, proved by Mr. Watson's Experiments. See his *Treatise on large Circuits*, Page 54,

Again, to increase the Circuit, let two, three, or more Persons, all join Hands, and the Person at one Extremity either touch the Coat of the Condensing-phial, or else hold it in the Hand at Liberty; then let the Person at the other Extremity bring his Hand to the aforesaid Wire which leads into the Bottle, and they will all at the same Instant receive an equal Shock; and this, as is well known, will equally succeed, let the Number of Men be ever so great, and the Circuit ever so much enlarg'd.

This Experiment may be otherwise vary'd.

Let the aforesaid Number of Men, or, if you please, a whole Army, form themselves into a Circle, or a Circuit in any other Form, all joining Hands, excepting two only; one of which taking the prepar'd Phial into the Hand at Liberty, holding it by the coated Part; then let the Person at the other Extremity touch the conveying Wire which leads thro' the Cork, and the Circulation will be instantly compleated throughout the whole Army, and every Individual will that Moment receive the Shock.

B. Is it not reasonable to suspect some great Deception in this Experiment; for how can it be suppos'd credible, that the largest Circle can be compleated, so as to move all round it in the same Space of Time as round the smallest, unles it were to move all at once, like a solid Wheel on its Axis, which, if the least Part of the Circumference were mov'd forward, the Whole must move; or like any solid Body of the greatest Length, which could not be push'd forward ever so little at one of the Extremities, but every Part must be equally affected; but this, it is imagin'd, cou'd never be the Case in that Experiment, if it were for no other Reason than that it is a Fluid,

and moves not in a Circle, but generally in an irregular Circuit?

A. As to its being incapable of moving like a solid Wheel, because it is a fluid Body, perhaps can be no just Reason; for, if it be compleatly elastic, the Compleatness of its Fluidity may be so far from an Impediment, that it may possibly very much contribute towards the Motion being equally free, whether its Passage be regular or irregular. And, that a Motion may be so swift as to appear instantaneous, we need only consider the Velocity of the solar Rays.

B. It was always much question'd, whether there was any such Thing in Nature as a compleatly elastic Body?

A. But this was before the Properties of Æther were so well known; we then were acquainted with nothing in Nature, except the Rays of Light, so elastic, as to propagate a Motion so instantaneously to the greatest Distance, by almost the least Impression or Impulse, and this, though the Wire in which it is contain'd, be ever so often turn'd and return'd. It is true, this appears so great a Paradox, that, if it were possible, we should be ready to disbelieve our very Senses; but as Facts are so stubborn as to yield to no Arguments, however subtle or nicely form'd; so we are at length forc'd to submit, and it is presum'd the greatest Philosophers will never be able to account for this wonderful Phænomenon, unless they ascribe to Æther such a Property as was imagin'd to belong to no kind of Matter in Nature, namely, that of perfect Elasticity, or what makes a very near Approach to it; altho', as above, such a perfect Elasticity in the subtil Medium must seem absolutely necessary to perpetuate that vibratory Motion, which Sir Isaac Newton conceives not only to sub-

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sist in it, but also to be the Cause of many of the greatest Operations in Nature.

This Tendency to circulate, and that in the shortest and nearest Way possible, is so remarkably great, that no Length or Breadth even of Waters can prevail with it to disperse or spread itself from the Point of Direction given ; it having been prov'd along the Sides of Rivers, and across large Lakes of some Miles ; some of these Accounts being first communicated from *Paris*, Mr. *Watson*; and several other Members of the Royal Society, try'd the same Experiment with Success, across the River *Thames*, at the new Bridge, *Westminster* *.

Another Time at *Shooters-Hill*, about eight Miles from *London*, he, with nine more of the Royal Society, made other Experiments, in order to prove whether the electrical Fire would revolve in larger Circuits, and whether the Shocks could be sensibly felt at greater as well as lesser Distances ; and also to ascertain its Celerity : They were therefore made with the greatest Circumspection and Exactness ; which thoroughly convinc'd them, it was not in their Power to form a Circuit so large, but that the Revolution always appear'd as instantaneous as Light from the Sun, notwithstanding one was form'd of four Miles, at which Distance they also found the Shocks to be exceeding great.

B. In what Manner are we to conceive this surprising Shock and Circulation to be generated or produc'd ?

A. Before any adequate Idea can be formed, it will be necessary to consider,

First, That Universality and extreme Subtilty

* From the Condensing-phial on the South Side of the Water, were Wires convey'd over the Bridge, to the Water on the North Side, which convey'd it back to the Phial again; or to Wires contiguous to it.

of Æther, which is observ'd by Sir Isaac Newton, and many other eminent Philosophers, to be such, as to fill all Space as well as the minute Pores of all gross Bodies, and is most remarkable in those that are the most dense and compacted; for in these only it appears the most pure, active, and most formidable, agreeable to what we observe in the electrical Experiments: Those gross Bodies, which are less dense and compacted, being observ'd to admit of the more gross and less active Particles of the common Air, which are ever found to be a most remarkable Obstacle to the free Action of the pure Æther.

Secondly, A general Law, which is observ'd to obtain in homogeneous Fluids, not only of an apt and ready Union, but also of the lesser constantly escaping or vanishing into the greater; as when two Drops of Water, a greater and a less, are brought in Contact; they will not only cohere and unite, but the lesser Drop is always observ'd to rush or escape with Violence, or be attracted, into the greater; and, in two such Drops or Globules of Mercury, this Propensity seems much greater, for, the greater the Density of the Fluid, the more this Principle is observ'd to prevail; and, the more compleat the Fluid, still the greater this Propensity; this subtil Medium then being, in all Probability, a most compleat dense Fluid *, such Propensity is observ'd in a most eminent Degree.

Thirdly, The fix'd Æther, contain'd in the Pores of the Glass, is observ'd to be a most firm Bond to the electrical Matter, and consequently no small Contributor towards producing the Shock, by first arresting and detaining a sufficient Quantity of it;

* Sir Isaac Newton tells us, it fills all Space adequately without leaving any Pores, and by Consequence is much denser than Quicksilver or Gold. *Optics, Quar. 22.*

and we may be well assur'd, by many Experiments, that this subtil Medium, when convey'd into the Phial, is most powerfully attach'd to the fix'd Æther in the Glass, where the Attraction also appears remarkably active; for, if we darken the Room, when the Machine is in Motion, and the Condensing-phial suspended on it, we no sooner lay a Finger on the Phial, or any Piece of Chain or Wire hanging to it, not reaching to the Floor, but the original Æther contain'd in the Pores of the Finger is instantly attracted into it with such Violence, as to cause a small Flash of Light in the Phial *.

That this is caus'd by an additional Supply attracted from the Finger, and again supply'd by the Earth, will appear by considering, that, when the Phial is suspended on the Gun-barrel, &c. it receives not sufficient Strength to produce a Shock, till a Hand, Finger, or some other dense Non-electric, in Contact with the Floor, be laid on it, or to any Bit of Wire, &c. hanging to it: This may be prov'd, by attempting to produce a Shock as soon as the Fingers are laid to the Phial, which will not then succeed; but, after Continuing it on a small Time, and it has receiv'd a greater Supply from it, the Shock will then succeed, and consequently the Circulation, as above †.

And, farther to prove that the Condensing-phial does actually attract such a Supply from the Earth, let the Person who tries the Experiment step on a Cake of Resin, which cuts off its Communication

* This is scarcely perceptible, except the Phial, instead of being furnish'd with Filings, be lin'd with leaf Gold; but then, if the Room be darken'd, it always appears

† By this it appears, that the Phial, by hanging on the Machine, is only put into a State of Attraction — but, when the Hand is laid on it, it does then actually attract a sufficient Supply from it.

with the Earth, and then no Shock will be produc'd, although his Hand be continu'd on the Phial ever so long.

And still, if farther Proof were necessary, that the most remarkable Attraction is towards the excited original Electric, whether Glass, Amber, &c. Mr. *Rackstraw's* Experiment on his Sulphur Globe puts it beyond Dispute; in which Experiment, Streams of Fire are seen issuing out of the Pores of the Fingers, though at three Inches Distance, rushing on the Globe with such Violence, making such a whizzing Noise, and causing so great a Light, as to be sufficient to startle the Person who tries the Experiment.

B. If Mr. *Rackstraw's* Experiment prov'd ever so plainly, that the Motion of the electrical Æther was from the Fingers to the revolving Globe, yet that can be no Proof, that the Motion is from the Fingers, or other Non-electric, to the Condensing-phial; for, although the electrical Æther be accumulated at each, yet, the one being excited by the Attrition of the Hand and Glass, and the other not, the Direction of the Motion might be determin'd by such different Causes, as to have very different Effects?

A. But as the Accumulation in both Cases appears so plainly to be furnished immediately by the Earth, *Experiment 1st, p. 34 and p. 58.* it will be natural to expect the Effect to be the same at the Phial and at the Globe, after Accumulation, whether it be caus'd by Attrition, or not; and the absolute Cause of the Attraction and firm Adhesion of the electrical Æther to the Phial and Globe appears to be the fix'd Æther in their Pores; and this will always be the Case, whether the Globe be of Glass, Amber, Sulphur, Sealing-wax, &c.

Upon the Whole, the fix'd Æther, contain'd in the Pores of the glass Phial, appears to be the
first

first and principal Cause of all the late great Improvements, consequently the Cause of our beholding it act in so formidable a Manner; for, had it not been for the fix'd Æther in the Phial, Professor *Muschenbroek* had never discover'd the Shock; and the looser Æther uniting with the fix'd Æther in Glass, or other original Electrics, will, I am thoroughly persuaded, be found a much more powerful Cause of the late great Improvements in Electricity than is generally imagin'd, and the only Cause we are able to detain it, at any Rate, long enough to make the Experiments.

But the greatest and chief mechanical Cause, why Motion is so instantaneously propagated to distant Parts, Philosophers ascribe to a perfectly elastic Quality of the subtil fluid Æther, or at least, I say, to what seems to make a very near Approach to it; and this must undoubtedly be the only Cause of the Shock, and why the Motion is so instantaneously communicated from the Condensing-phial to distant Parts.

B. What is the chief Property of a perfectly elastic Body?

A. That the Force of Restitution be equal to the Force of Compression, as above, at p. 48.

According to Dr *Quincy*, in his *Physical Dictionary*,

" If two such Bodies strike one against another, " there will be, or remain in each, the same re-
" lative Velocity as before, i. e. they will recede
" with the same Velocity as they met together
" with. For the compressive Force, or the Mag-
" nitude of the Stroke in any given Bodies, arises
" from the relative Velocity of those Bodies, and
" is proportional to it: And Bodies perfectly
" elastic will restore themselves compleatly to the
" Figure they had before the Shock; or, in other
" Words, the restitutive Force is equal to the

" compressive, and therefore must be equal to the
 " Force with which they acceded, and conse-
 " quently they must, by Elasticity, recede again
 " from each other with the same Velocity. Hence,
 " taking equal Times, before and after the Shock,
 " the Distances between the Bodies will be equal :
 " And therefore the Distances of Times, from
 " the common Center of Gravity, will, in the
 " same Times, be equal. And hence the Laws
 " of meeting Bodies, perfectly elastical, are easily
 " deduc'd." —— Accordingly he proceeds to a
 Demonstration.

B. But, tho' this be allow'd in solid and firm
 Bodies, yet, as the component Parts of a Fluid are
 suppos'd to be such as freely to flow by or over
 each other, and, the more freely those Particles
 slide by each other, so much the more perfect is
 the Fluid : How can it be reasonably imagin'd,
 that such a yielding Substance should propagate
 Motion so instantaneously to distant Parts, as we
 observe it to do in those electrical Operations ?

A. You must take Care not to confound an elastic Fluid with other Fluids, for an elastic Fluid
 will, on Examination, be found as different from
 all other Fluids, as if they were quite contrary
 Things.

To prove which, I shall transcribe the ninth
 Page of the *Universal Magazine* for January 1755,
 on Fluidity :

" The Nature and Cause of Fluidity has been
 " variously assign'd. The *Gassendists* and ancient
 " *Corpuscularians* requir'd only three Conditions as
 " necessary thereto, viz. a Smallness and Smooth-
 " ness of the Particles of the Body, Vacuities in-
 " terpers'd between them, and a spherical Figure.

" The *Cartesians*, and, after them, Dr *Hooke*,
 " Mr *Boyle*, &c. besides the Circumstances above-
 mention'd, require a various, perpetual, inten-
 " tive

" fine Motion of the Particles of the Body, as that
" which principally contributes to Fluidity.

" According to these Philosophers, therefore,
" Fluidity consists in this : That the Parts of the
" Body, being very fine and small, are so dispos'd,
" by Motion or Figure, as that they can easily
" slide over one another's Surfaces all Manner of
" Ways ; and that they be in constant, various,
" separate Agitation to and fro ; and that they
" only touch one another in some Parts of their
" Surfaces.

" Mr Boyle, in his History of Fluidity, men-
" tions these three, as the principal Conditions re-
" quir'd to Fluidity.

1. " The Minuteness of Parts : As, in Effect,
" we find that Fire, by dividing Metals into fine,
" small Parts, renders them fluid ; and that acid
" Menstruum dissolves and render them fluid after
" the like Manner ; and that Fire turns the hard
" Body of common Salt almost wholly into a Li-
" quor, by Distillation : Not but that the Figure
" of the Particles may have a considerable Share
" in Fluidity.

" Thus Mercury, whose Parts are, doubtless,
" much grosser than those of Oil and Water, is
" yet more fluid than either of them : And thus
" Oil, by the Action of Fire, may be converted
" into a consistent Substance, like Butter.

2. " Store of Vacuities * interspers'd between
" the Corpuscles, to give Room for the several
" Particles to move among themselves.

3. " A Motion and Agitation of the Corpus-
" cles, either from some Principle of Mobility
" within themselves, or from some extraneous A-

* The elastic fluid Æther is so widely different from a com-
mon Fluid, as to have no Vacuities, but fills up all Space ade-
quately, without leaving any Pores. *Optics, Quær. 22.*

“ gent, penetrating and entering the Pores, moving variously among them, and communicating to them Part of its Motion.

“ That this last is the Qualification chiefly required in Fluidity, he argues from divers Observations and Experiments.

“ Thus, a little dry Powder of Alabaster, or Plaister of *Paris* finely sifted, being put in a Vessel over the Fire, it soon begins to boil like Water, exhibiting all the Motions and Phænomena of a boiling Liquor: It will tumble variously in great Waves, like that; will bear Stirring with a Stick, or Ladle, like that, without Resisting; nay, if strongly stirr'd near the Side of the Vessel, its Waves will apparently dash against them; yet is it, all the While, a dry, parched Powder.

“ The like is observ'd in Sand: A Dish of which being set on a Drum-head briskly beaten by the Sticks, or on the upper Stone of a Mill, it in all Respects emulates the Properties of a fluid Body: A heavy Body, *e. gr.* will immediately sink in it to the Bottom, and a light one emerge to the Top. Each Grain of Sand has a constant vibratory and dancing Motion; and, if a Hole be made in the Side of the Dish, the Sand will spin out like Water.

“ That the Parts of Fluids are in continual Motion, the *Cartesians* bring divers Considerations to prove: As, *1st*, The Transmutation of Solids into Fluids, *e. gr.* Ice into Water, and *vice versa*; the chief Difference between the Body, in those two States, consisting in this, that the Parts, being fixed and at Rest in the one, resist the Touch; whereas, in the other, being already in Motion, they give Way upon the slightest Impulse. *2dly*, The Effects of Fluids, which commonly proceed from Mo-

“ tion:

tion : Such are the Inſinuation of Fluids among the Pores of Bodies ; the Softening and Difſolving of hard Bodies ; the Actions of corrodive Menſtruums, &c. Add, that no Solid can be brought to a State of Fluidity, without the Intervention of some moving or moveable Body, as Fire, Air, or Water. Air the same Gentlemen hold to be the first Spring of these Caufes of Fluidity, it being this that gives Motion to Fire and Water, though itſelf receives its Motion and Action from the Æther, or ſubtil Medium.

“ Boerhaave pleads strenuously for Fire’s being the first Mover and Cause of all Fluidity in other Bodies, as Air, Water, &c. Without this, he shews, that the Atmosphere itſelf would fix into one ſolid Maſs.” So much for a common Fluid.

But as we can form no adequate Conception concerning an elastic Fluid, but what is both dilatable and compressible, which other Fluids are not, or very few, and those in a ſmall Degree ; and as common Air is the moſt remarkable elastic Fluid, we are well acquainted with ; let an elastic Fluid, like the Air, be imagin’d to be compos’d of Parts that are both dilatable and compressible ; then, although in a common Fluid, the Parts are ſuppos’d to ſlide eaſily over each other, we can’t help conceiving the elastic Fluid to be very foreign, and widely diſferent from any of the above-mention’d Fluids : And if Æther be 700,000 Times more elastic than Air, which is Sir Isaac Newton’s Proportion, then Æther muſt endeavour to expand itſelf more than Air in the ſame Proportion.

If then the Disproportion of the elastic Force between Æther and that of common Air be ſo exceeding great, notwithstanding the Expansiveness of Air has been magnify’d to an extravagant De-

gree, *viz.* that if it were possible to place a cubical Inch of Air, of the same Density it is of, in its natural State at the Earth's Surface, in a Vacuum, where there was sufficient Room; that then it would probably expand itself, till it had fill'd a Sphere, whose Diameter was equal to the Diameter of the Orbit of *Saturn*.

This exceeding great Propensity to expand itself from so violent a compress'd State, (particularly when so much more than is natural is crowded into the Condensing-phial) is naturally suppos'd to be the Reason of the several Parts pushing each other in all Directions, especially those in that particular Direction which receives the Impression; but more especially in that particular Direction of the Circuit, which is form'd for the same Purpose, from the Phial to the Phial again; for that appears to be the only Canal for the free Passage of the Æther, to the Vacuum form'd at the Phial, by Means of the violent Explosion; so that the Motion

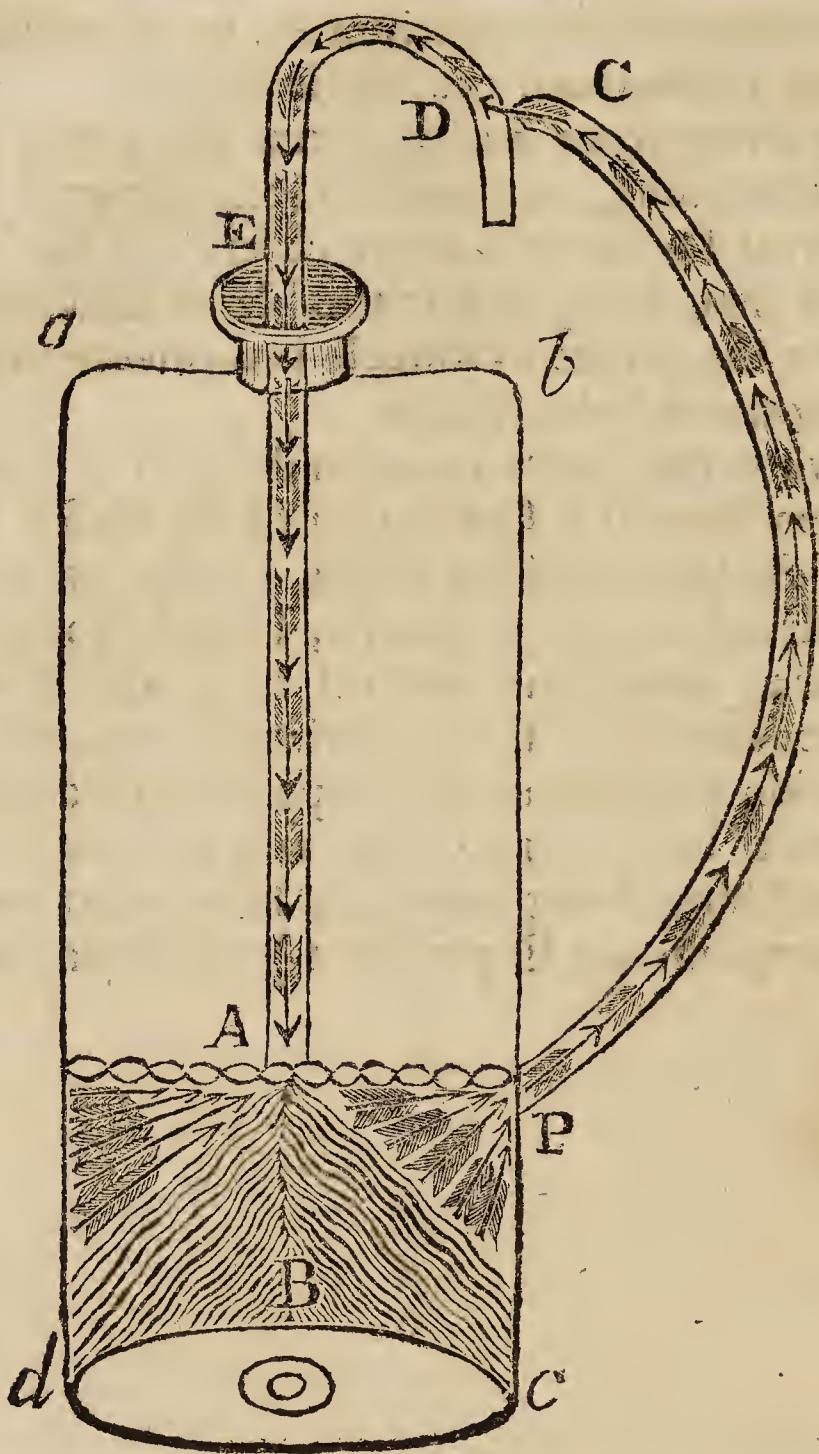
tion to restore the Equilibrium is, to Appearance, instantaneous throughout the whole Circuit.

What strengthens and confirms the above Method of Reasoning, is, that such instantaneous Motion to great Distances is never observ'd in the open Air; for that, being so remarkable an Electric *per se*, proves the greatest Obstacle imaginable to such a free Motion of the Æther.

But when the above-mention'd Canal is open'd, *viz.* when there is a Continuity of the elastic Particles of Æther to distant Parts, I mean, when the non-electrical Circuit is form'd, in order to convey the Shock; then, and not till then, the Theory seems confirm'd by the Experiment, and we find the Motion instantaneously propagated throughout the Circuit, be it ever so great and irregular.

These Things being premis'd, I shall next endeavour to explain the Experiment by Delineation.

Let



Let *a, b, c, d,* be the Condensing-phial.

P C, joining to the Phial at *P,* be call'd the Connecting-wire, or Connecting-line.

D E A, leading through the Cork, be call'd the Leading-wire.

A c B d, the tinsel Fringe, reaching from *A,* the Bottom of the Leading-wire to the Bottom and Sides of the Phial, that so the electrical Matter de-

The fiery Arrows in the Connecting-wire and Leading-wire, &c. are to represent the Course steer'd by the Æther.

scending

scending through the Leading-wire may be convey'd to the gold Lining of the Phial.

P. The electrical Fulciment, Fulcrum, or Prop, viz. that Part of the original Æther contain'd in the lower End of the Connecting-wire.

Note. That, whereas the electrical Matter and the universal Æther so plainly appear to be one and the same identical Substance, it is presum'd it will be thought a sufficient Reason for my Taking the Liberty of calling the electrical Matter, by Way of Distinction, the electrical Æther.

First then : Let the Condensing-phial be suppos'd charg'd with electrical Æther, and held in the Hand ; and, if all Things are replete with the universal Æther, consequently the internal Parts of the Connecting-wire C P are replete with the same Principle ; as also of the Leading-wire D E A, which Leading-wire is likewise envelop'd in an Atmosphere, surrounding it, to a considerable Distance, with the electrical Æther ; the electrical Æther is also conceiv'd to be most intimately connected with the original Æther contain'd in the Pores of the gold Lining of the Phial ; and also to the same in the Pores of the leaden Coat of the Phial *, but more especially to the fix'd Æther in the Pores of the Glass : Æther, then, seems to cohere with Æther so firmly, as to cause the Condensing-phial to appear a most strong Hold ; and all the great and powerful Attraction is for the above Reasons conceiv'd to be there.

As then the Condensing-phial, with its Contents when thus charg'd, in Conjunction with the Lead-

* Although the fix'd Æther, in the Substance of the Glass, does not suffer the electrical Æther to fly through it so freely as through Non-electrics ; yet it is observ'd to pervade the Glass, so as to snap against the Finger from the leaden Case, when suspended to the Gun-barrel.

ing-wire, is observ'd to be so powerful an Attractor; all other Parts of Æther appear to be attracted towards it, and the Æther contain'd in all other non-electrical Bodies, when brought near enough, is observ'd to escape, or be attracted into it; therefore the original Æther contain'd at C, in the Connecting-wire or Line, reaching from the Coating of the Phial at P, when brought to D, escapes, or is attracted into it.

But, at the Instant the Æther is attracted from C into D, the whole remaining Column, quite to the other End at P, of the Connecting-wire or Line CP, instantly expands, and is consequently weaken'd; thus, the Prop P giving Way, the whole Quantity in the Phial bursts from its State of Confinement and follows it; so that the End C of the Connecting-wire may be suppos'd faintly to resemble a feeble Water-fluice, which, by being brought near to D, fails, and the whole Flood consequently rushes forward; in a similar Manner, the Æther in the Wire is conceiv'd to act, and therefore must rarify throughout; by which Means P, the feeble Prop, may naturally be expected to fail, particularly as the Compression or Condensation of the Æther in the Phial was so great as to cause it to be just ready to burst of its own Accord, which it very frequently does, without joining the Circuit at CD; or, if it will render it more easy to be conceiv'd by any who may not clearly apprehend me,

Let the whole Quantity of condens'd Æther in the charged Phial be compar'd to an exceeding strong Spring, which, from the most perfect compress'd State, instantly flies open and drives all before it; especially through the Channel PC, which is form'd for its Passage; and thus the Circuit is compleated through the Connecting-wire PC, and through the Leading-wire DEA, to the Part

where

where this intestine Eruption was first generated ; that is to say; to *restore to an Equilibrium* the hungry Vacuum generated in the Phial; by Means of that violent and sudden Expansion made at the Bursting of the Fire in it ; which Flash of Fire we always behold; if the Inside of it be lin'd as before-directed; instead of being furnished with Filings of Metal ; such *Restoration*; there is the greatest Reason to believe, never fails of being perform'd at the Instant the Circuit is compleated ; viz. at bringing the Point C, either to the Point D; or else to any other Part of the excited Apparatus; which has a Communication with the Point D, since we never fail of Feeling the Effects of it, particularly if our Arins and Breast form any Part of the Circuit.

And this is observ'd to be invariably the same; whether the Line P C be long or short; crooked or straight ; whether it be compos'd of Metals, Animals, Waters, or green Vegetables ; or whether it be compos'd of some, or all these together.

N. B. If what I have said is not satisfactory, I wish I was capable of conveying my Meaning in a more intelligible Manner:

I have in this Experiment consider'd the Condensing-phial; as held in the Hand; though the Effect is equally the same, whether it be took off from the Gun-barrel when excited, as was suppos'd above; or whether it remains suspended on it:

If the Phial be suspended on the Gun-barrel or Wires, when the Circuit is form'd, it is not material whether it be touch'd at the Leading-wire as before ; for (as was observ'd above) the End C of the Connecting-line may be brought in Contact with the excited Apparatus of Wires, either near the Phial or at any Distance from it, and it succeeds equally if it has but a Communication with it.— As to the Shocks; they appear to be entirely owing

ing to the Violence of the Motion, when passing through Parts which make the greatest Resistance.

B. Since you say, if the End C of the Connecting-line be caus'd to compleat the Circuit, though it be not near the Phial, but at any other Part of the excited Apparatus, yet the Effect is the same; how then do you know whether a Circulation to the Inside of the Phial again is compleated or not?

A. To prove this, and whether a Shock could be given without forming a Circuit, I made the following Experiment.

Having two Machines in the same Room, I put them both in Motion, and endeavour'd to produce a Shock by taking Hold of the Connecting-line from the Phial suspended on one of the Machines, and bringing a Finger of my other Hand to the Leading-wire of the Phial which hung on the other Machine: This had not the least Effect in producing a Shock, but was in all Respects the very same as if I had had no Communication with the Phial on the other Machine.

That I might not be mistaken, I repeated the Experiment several Times.

Quæry. If a Circulation was not perform'd, when a Shock is given, what probable Reason can be assign'd, why no Shock should be felt in the latter Experiment? For, notwithstanding, according to the general Law of Fluids, the lesser ought to escape or be attracted into the greater, *viz.* from the Finger to the Leading-wire of the Phial on the second Machine; yet this we find not sufficient to cause it to expand, so as to weaken the electrical Prop, at the lower End P of the Connecting-wire of the Phial suspended on the first Machine.

Does not the Cause seem manifestly to be for Want of a proper Communication?

At the Breaking forth of the Fire from C to D, in the former Experiment, does not the universal
or

or original Æther, contain'd in the whole Connecting-line from C to the Prop at P, appear to move or expand itself, all at once, *i. e.* not only at C, but also at P, as well as all the intermediate Parts? And, when the Prop gives Way, does not the invisible Fire in the Phial that Instant become visible, and appear to burst out from its confin'd State in the Phial, and follow it? And, as so violent an Expansion had caus'd so compleat a Vacuum in the Phial, does not the original Æther in the internal Parts of the Leading-wire, hurried on by the Impetuosity of what issu'd from the Connecting-wire, as instantaneously seem to move on to restore the Equilibrium? For, without all these Requisites, neither Circulation is perform'd nor Shock felt, as is evident in the latter Experiment.

And, though it is not easy to conceive that all this can be perform'd in the same Moment of Time, yet the Effect undeniably proves it to be Fact; and that not only in short Circuits, but even when the Connecting-line has been of the greatest Length that could possibly be form'd; and, perhaps, compos'd, as above, of Animals, Metals, and Waters jointly; and though Part of the Earth itself has been sometimes made a Part of the Circuit.

But that neither Shock or Circulation is perform'd without a Communication of the Parts as above, may be farther prov'd, by suspending the Condensing-phial on the Gun-barrel, grasping it with one Hand, and bringing the other Hand either to the hooked Leading-wire, or to any other Part of the excited Apparatus, and the Shock is produc'd, and consequently the Circulation perform'd; but, if the Phial be lifted off with the Hand, and the Gun-barrel touch'd with the other Hand, no Shock will be felt; but, touching the

Hook of the Leading-wire, a Shock is receiv'd in both Elbows.

Having had many Thoughts concerning the Manner in which the Circulation and Shock was perform'd, I thought I would try if the Experiment could be so inverted, as that, instead of producing a Shock by touching the Leading-wire of the Phial, it were touch'd at the Coating of the Phial, when suspended on the Gun-barrel ; but as this Experiment could not be made, while standing on the Floor, with the other Hand on the excited Gun-barrel ; because, if it be touch'd by any one standing on the Floor, it escapes from the Gun-barrel, directly into the Floor, so that no Fire or Attraction is to be found (by Experiment the Second) ; I therefore consider'd that the Experiment would be the same, and answer in all Respects, if I was electris'd in the common Way, by standing on the Resin, holding the Condensing-phial by the Leading-wire, in one Hand, and, in Order to produce the Shock, touched the Coating of it with the other : This, when it was first try'd, would by no Means succeed, but by Accident a Person standing on the Floor took Hold of the Phial ; at which Time I touch'd it again, and receiv'd a strong Shock in my Elbows as usual ; but what seem'd yet more surprising, was, that the Experiment would equally succeed, though the Hand were taken off again a considerable Time before I touch'd it.

This Experiment seems to confirm the other at Page 37, by Acting so much like it, each one proving that the electrical Æther collected in the Phial was not sufficient to produce the Shock, till the Phial had attracted an additional Supply from the Finger ; and that this was furnish'd from the Earth is quite clear in both Cases : In the Former, by finding it not strong enough to produce the Shock

Shock at the first Putting on of the Hand, and by the Latter, till touch'd also by the Person standing on the Floor : And both these Experiments, as well as Mr. *Rackstraw's*, on his Sulphur-globe, either separately or jointly, illustrate and confirm the Truth of the first Assertion and capital Experiment, Page 19.

In a Word, let this Experiment be diversify'd and alter'd into ever so many different Shapes ; yet, still, the greatest and most wonderful Attraction imaginable appears to be not only towards the glass Globe in Motion, but towards the Condensing-phial also, in whose Pores this powerful Principle seems so fix'd, and cohering so firmly with the electrical Æther.

N. B. The Way and Course it steers in this Experiment I have taken the more Pains to discover, as it may be necessary to be known, when treating of bodily Disorders.

The Knowledge, also, of the Course which the electrical Æther takes, when convey'd on the Apparatus and touch'd by a Non-electric, may for the same Reason appear necessary to be known.

B. But I am not yet fully satisfy'd concerning the Course and Direction of the violent Motion ; whether from the Connecting-wire to the Leading-wire ; or whether from the Leading-wire to the Connecting-wire, that is, whether from the Finger of the Person who holds the Connecting-line, and so to the Phial ; or whether from the Phial into the Finger, and from thence into the Earth ; particularly as we find in it so strong an Inclination to return thither.

A. Notwithstanding its great Tendency to return into the Earth, this will by no Means be found equal to that of compleating a Circuit, in which Experiment, that Tendency is so remarkable, as even to pass through a Part of the Earth, and out

of it again, in Order to arrive at the Phial where the Motion was generated *, to restore the Equilibrium,

Another Reason for Believing that the Attraction is from the Finger or Connecting-line towards the Leading-wire, is, that, when the electrical Æther is convey'd to the human Maladies, with such a Supposition of its Motion, no bad Accident has ever been observ'd to happen, but of this farther on.

N. B. This last Reason I mention, on no other Account than because some who are no Friends to the Method of electrical Treatment of bodily Disorders, have endeavour'd to persuade the World, that the morbific Matter, which, before, was only lodg'd at a superficial Part, was by those electrical Operations forc'd inwardly on the more noble Parts; which must be very unlikely, if the Motion of the electrical Æther be outwardly.

Another Experiment, which points out the exceeding Elasticity of the electrical Æther, is the following:

When the Operation is perform'd of simply electrising a Person on the Resin, and drawing off Sparks at the same Time with a large Wire or small iron Rod: At the Instant the Person is touch'd, it is not only felt like a Pulse under the Finger, when laid on any other Part of the Person so electris'd; but if several Persons stand in a Row, or in any irregular Form; and the first lay a Finger on the Face or the Back of the Hand of the Second, the Second lay a Finger on the Face or Back of the Hand of the Third, the Third in like Manner on the Fourth, &c. when the First brings the iron Rod in the Hand at Liberty to

* See Mr. Watson's *Treatise on large Circuits*, Page 54.

the Flesh of the Person electriss'd on the Resin ; at the Bursting of the Fire from the electriss'd Person to the iron Rod, every Person, at the Part in Contact, feels a Pulsation ; this is equally the same at any Part of the Body ; and when it acts vigorously, and the Room is darken'd, the Fire is visible where the Pulsation is felt, *viz.* at the Motion of the Æther when passing through Air out of the Finger of the one into the Hand, &c. of the other, particularly when they touch but very lightly ; this I have observ'd in the Day-time, even when I have been at the Distance of two or three Persons from him who touch'd the electriss'd Person : So that the Æther plainly discovers itself to be Fire, by the least Agitation, *viz.* by Passing swiftly through the smallest Space of Air, out of one dense Body into another ; this will always be found the Case, when its acts strong, and when carefully view'd *. But, as each Person stood on the Floor, it seem'd to lose a Part of its Virtue by Escaping into the Earth ; for at the first Person it was stronger than at the Second, and at the Second than at the Third, &c. but, if all had stood on Cakes of Resin, except the last of all, it would have been equally the same throughout the whole Length, though ever so great.

The Motion of the Æther in this Experiment seems widely different from the Motion of the Æther in the foregoing Experiment, for in this the same Motion may be observ'd to be alike continu'd in all Parts of the Body or Bodies ; but in the other, that is, when the Shock is given, it appears to act the most vigorously in a direct Line, as,

* The Visibility of the Fire, in this Experiment, and in all others, seems to be occasion'd by its Passing so swiftly through the Air into the next dense non-electrical Body, that so it may arrive at the Earth, or else to the Phial.

(where it is not by the Air, or otherwise hinder'd) when passing through Waters, &c. to or from the Condensing-phial; for then the violent Motion seems to be propagated rather in a Column, from and to the Phial.

N. B. Sometimes, when the Air is moist, this last mention'd Experiment will not easily succeed; but as I have two Machines in the same Room, one of which is furnish'd with two Globes, it is very seldom but I can procure as much of the Fire as is sufficient for any Experiment.

B. But how can you be so vain as to imagine you have made a plainer Discovery, not only of the Source or main Spring from whence the electrical Æther is deriv'd, and where it returns, but also of its Motion and the Course it steers, than any other? Pray what have you done in this more than Mr. *Watson*? Has not he long ago, by a great Number of Experiments, prov'd that this subtil Medium is produc'd out of the Earth, and as plainly shewn the different Ways and Manner wherein it may be observed to pass from the Earth to the Machine; which may be seen at large in his *Sequel*, at the 47th and several of the following Experiments? You seem, indeed, to differ with him in your Imagining that his Electricity never passes out of the Earth directly to the Gun-barrel or Wires, but from the Earth to the prime electrical Globe or Tube only; whereas he hath plainly shewn, in various Cafes, that the Motion, or the Course it takes, is as directly from the Earth, or Finger, to the Gun-barrel and Wires likewise.

A. I hope that ingenious Gentleman will excuse me for differing with him in Opinion, particularly when I have given my Reasons for it: As to his Opinion that the Æther is furnished from the Earth to the revolving Globe, this is so obvious as not

to be deny'd ; and my first Experiment exactly agrees with those he has produc'd to prove it.

But that its Tendency is also from the Earth, or other unexcited Non-electric, directly towards the excited Gun-barrel, or Apparatus of Wires, &c. must seem a Contradiction, and is accordingly as plainly contradicted by my second Experiment, which constantly and invariably shews the Course of its Motion to be determin'd from the excited Non-electrics the nearest Way, thro' the first dense unexcited Non-electric in Contact with it, into the Earth from whence it came, as swift as Light ; but if no unexcited Non-electric in Contact with the Earth comes near the excited Gun-barrel or Wires, it is then, after it has seemingly cling'd as long to them as it can, forcibly driven off, particularly at their Extremities, into the Air ; but into which it will never pass, if it can find any Canal whereby it may escape into the Earth ; and, that this can be no Deception, we are well assur'd by its Invariableness : And this Experiment is likewise so easily made as to be in the Power of almost any one, who comes near an electrical Machine, to prove it.

As for the several Experiments you mention, they are far from proving the Contrary ; I shall therefore attempt to discover wherein the Fallacy lies.

In his *Sequel*, from Experiment forty-fourth or forty-fifth to Experiment fifty-second, he has taken Notice of many remarkable Circumstances, which were discover'd, while the Machine was mounted on original Electrics ; most of which, indeed, plainly prove the Current of Æther to be determin'd by the mighty Attraction at the glass Globe excited by the violent Attrition of the Hand, &c. but he thinks they plainly discover that the Current of Æther is directly from the Earth to the Gun-barrel or Wires, in these and all other Cases, equally ;

equally ; and tells us at Experiment fifty-second,
 " If, when the Machine is mounted on original
 " Electrics, any one, while standing on the Floor
 " brings a Finger, but especially a pointed iron
 " Rod, near the Gun-barrel, or even to the iron
 " Axis of the Wheel, it may be plainly discover'd
 " to issue from the Point of the Rod (*viz.* when
 " the Room is darken'd) in diverging Rays, to-
 " wards the Gun-barrel, &c."

This he conceives to be a plain Proof that the Tendency is always equally from the Earth to the excited non-electrical Apparatus, as from the Earth to the excited prime electrical glass Globe.

But as never any Thing like this will be observ'd, except the Machine is plac'd on original Electrics; a little Consideration will be sufficient to point out the Deception : For, while the whole Machine is supported by original Electrics, the Gun-barrel, or Boss at the End of it, which at all other Times receives the Æther from t' e prime electrical glass Globe only, is by this Means become the Instrument of Friction ; or, at least, acts the same Part, by supplying or furnishing the Globe with Æther ; which Supply is furnish'd from the Earth, as before, though more indirectly, *viz.* through the Person on the Floor, who holds the pointed Rod near the Gun-barrel or iron Axis of the Wheel, &c. for as the Person with his Hand on the Glass, in this Experiment, is also supported with original Electrics, and for that Reason is incapable of furnishing a Supply as in the common Experiments (for all that he now seems capable of, is, by the Attrition of his Hand, to put the Globe into a State of Attraction) the said Supply must necessarily be furnish'd from the tinsel Boss at the End of the Gun-barrel, in Contact with the revolving Globe ; the Boss supply'd from the Gun-barrel, the Gun-barrel from the pointed Wire abovemention'd,

tion'd, the pointed Wire from the Person who holds it, and the Person supply'd from the Earth: So that in this Experiment, although the Gun-barrel, or rather the Boss, seems to act the Part of the Instrument of Friction; yet the Surplusage appears to be return'd again from the Globe to the Gun-barrel, because it will then act again, he tells us, as in the common Experiments, when the Machine is not thus supported with original Electrics.

The next Experiments he produces to prove it *, are the 58th and 59th, where, by the Power of Electricity, a silver Leaf is suspended between two Plates, when the Uppermost is electrify'd, the other not; " This he observes must necessarily be effected by two opposite Motions, for he says no Body can be suspended in \AA equilibrio, but by the joint Action of two different Directions of Power: So here the Blast of electrical \AA ether from the excited Plate blows the silver Leaf towards the unexcited Plate; this last, in its Turn, by the Blast of electrical \AA ether from the Floor setting through it, drives the Silver towards the Plate electrify'd; and adds, We find from hence likewise, that the Draught of electrical \AA ether is always in Proportion to the Quantity thrown by the Globe over the Gun-barrel; or the Equilibrium by which the Silver is suspended, could not be maintain'd." And says,

" Now I conceive that the Space occupied by the Leaf of Silver, is that, where the Equilibrium of the electrical \AA ether is restor'd; because, if you take away the under Plate, through which, from the Floor, the Flux of this \AA ether is furnish'd; or if that Plate be placed on an original Electric, by which this Flux is likewise

* Here the Machine is suppos'd not to be mounted on original Electrics as before.

" prevented, the silver Leaf will be blown away."

But,

If this were so, and whenever an unexcited Non-electric was brought near an excited Non-electric, nothing more was perform'd than the Restoring the Equilibrium ; how comes it to pass that, when this unexcited is brought near the excited Body, so very little Fire or Attraction is to be found throughout the whole Apparatus of the Gun-barrel and Wires ? Particularly as this seems always in exact Proportion to the Nearness of the excited and non-excited Bodies, insomuch that, when they are brought in Contact, not the least Fire or Attraction is to be perceiv'd on any Part of the Apparatus. *Quæry.* Does not my second Experiment plainly prove it to be all the Time making its Escape into the Earth ? But

He takes Notice that it may perhaps be reply'd,

" That the suspended Silver may only serve as
" a Canal of Communication, which discharges
" the Electricity from the excited Non-electric to
" the unexcited ; and that when an originally E-
" lectric is placed between the lower Plate, in this
" Experiment, and the Floor of the Room ; that
" then the silver Leaf is attracted only, until the
" lower Plate is saturated with Electricity, and no
" longer". Then he adds,

" This is as much as Saying, that this Effect
" arises from Electricity, without mentioning in
" what Manner."

I answer, He has suppos'd that which appears to be the only true Manner whereby it is effected; therefore, no other satisfactory Reply can possibly be given.

B. But his 60th Experiment seems to prove it so undeniably to pass from the unexcited towards the excited Non-electric Body, that I beg Leave to relate the Whole.

" When the Silver lies still (though the Motion
" " of

" of the Globe is continu'd) between the two Plates, " one suspended to the Gun-barrel, and the other " placed upon an electrical Cake ; a Person stand- " ing upon the Floor needs only bring a small " glass Syphon, in a Vessel of Water, and apply " the long Leg thereof near the Plate plac'd upon " the Wax : For, upon this, the Silver is imme- " diately suspended ; and the Water, which be- " fore only dropp'd, now runs in a full Stream, " and appears luminous. Does not, in this Case, " the Current of the Water point out the Direc- " tion of the Current of electrical Æther ?"

A. I answer, no, for the capillary Syphon in this Experiment acts either Way, just as it happens to be, either the excited or unexcited Body ; in the same Manner as when we fire Spirits of Wine, which, if they are electrify'd, are kindled into a Flame, by bringing an unexcited Non-electric near them ; or else, when they are not electrify'd, are as effectually kindled by the Finger of an electrify'd Person,

Thus, in the Experiment of the Syphon, when unexcited, as in his abovemention'd Experiment the Current was from the unexcited Hand which held it towards the excited Plate ; yet, if the Syphon be plac'd on the Gun-barrel, and electrify'd, the Current of the Water will then be found to be towards an unexcited Finger, when brought near it. And

Whereas you seem'd inclin'd to believe that my Attempt, in this Essay, had not thrown the least Light on Electricity, as I might find by examining Mr. Watson's *Sequel* ; I can't help observing that there is not in that Tract, or any other, I ever saw, the least Mention made of the Reasons or Causes of two such different Qualities among natural Bodies, namely, those term'd Electrics and Non-elec-

* It is far from an absolute Proof in other Cases.

trics; which Cause, if I have mifs'd in original Electrics, I shall be very glad to find a more rational Account appear.

As to Non-electricals, the Experiments are so very clear, that the Way and Manner whereby the Phænomena are exhibited, cannot easily be mistaken: Again, as for our different Ways of explaining and accounting for the violent Shock given to the Parts of Animal Bodies, I shall not presume to determine concerning them, but shall leave them to the judicious Reader to determine, whether his Method or mine appears the most plausible; for which Reason, and that they may be the more readily compar'd, I take the Liberty to transcribe his Method of explaining it.

Sequel, Experiment 64th. "It remains now, that
"I endeavour to lay before you a Solution, why
"our Bodies are so shock'd in the Experiments
"with the electrify'd Water, &c. &c. &c.

"When the Phial of Water held in one Hand
"of a Man is highly electrify'd, and he touches
"the Gun-barrel with a Finger of his other; upon
"the Explosion which arises herefrom, this Man
"instantaneously parts with as much of the Fire
"from his Body, as was accumulated in the Wa-
"ter and Gun-barrel, and he feels the Effects in
"both Arms; from the Fire of his Body rushing
"through one Arm to the Gun-barrel, and from
"the other to the Phial."

N. B. These Animadversions on Mr. *Watson's* *Sequel* had never been made, had not some of the very same Objections been offer'd to my Manuscript, and the very same Essay of Mr. *Watson's* mention'd in Opposition to mine.

I have an ingenious Friend, who is an Operator in Electricity, and who, though he differs with Mr. *Watson* in his Manner of explaining the Shock, particularly when he affirms that the Fire from the

Body

Body rushes through one Arm to the Gun-barrel, and through the other Arm to the Phial ; yet, in my humble Opinion, is guilty of an Error equal to the former, though just the reverse, he imagining the Fire to rush from the Gun-barrel up one Arm, and from the Phial up the other Arm to the Body, when the Shock is given.

First, If either of these Hypotheses are just, how comes it to pass that the Fire breaks forth in such Abundance in the smallest Circuits, and in such Miniature in Mr. Watson's large Circuits ? And,

Secondly, How was the Fire sent from the north to the south End of *Westminster-bridge*, in Mr. Watson's Experiment ? And at what Point, on the north Side, did it *begin* to run over to the south Side ? Whether just in the Middle-way ; or whether just at the Water-side, through the great Waters, and, at the same Time, through the slender Wires, through both, from North to South ?

Thirdly, In Mr. Watson's large Circuit, at *Shooter's-hill*, which were sometimes compos'd of Animals, Metals, Waters, and Earth jointly :

Quæry, At what Part of the Circuit, must it begin to rush both Ways through the Circuit towards the Machine ; whether at one of those particular Parts, or whether just in the Middle of the Circuit ? And,

Lastly, Why the rapid Motion of the Æther is expected to begin so far from the Machine, rather than at the Inside of the Phial, where such a Vacuum was generated, by Means of that violent and sudden Expansion, occasion'd by the Bursting of the Fire in the Phial ?

And, doubtless, many like Difficulties must press equally hard in my worthy Friend's Hypothesis, which accounts for that violent Motion and Direction of the Fire, just the contrary Way.

As there is no Doubt, but both those very ingenuous

nious Gentlemen are sincere, and that their only Aim is to discover the Truth; so I can by no Means imagine, that either of them will be displeas'd at any just Objection that can be brought against their Hypotheses; because, if Objections were not allow'd in all Disputes, and afterwards, in a cool Manner, to consider the Objections thoroughly, and debate the same deliberately; then, farewell to all future Improvement in every Art; and, particularly, in whatever appears any Way mysterious. And,

As to my own Part, I solemnly declare, I have no other View in Making any Objection, than to discover, if possible, the very Truth in this important Subject: And,

Therefore, if I am mistaken, and consequently my Hypothesis wrong, I shall be heartily glad to be corrected, by a more rational Scheme.

DIALOGUE III.

B. **I**S this ætherial Medium necessary to the animal œconomy?

A. Yes, so absolutely necessary, that, without it, every Animal would very soon expire.

Though God alone is the Author and Preserver of all Things, and which he continually upholds with his immediate Hand; yet, the only instrumental Cause of our Being is this subtil Spirit, or celestial Fire, which in its natural State is doubtless too much for us in our present Existence; for which Reason, the all-wise and most beneficent Father of Nature has provided, for our Safety, the circumambient Atmosphere, to temper and bring it down to us in such a Manner as is most convenient for us, as well as all other earthly Beings, animate and inanimate.

This Fire, so temper'd, fitted, and adapted, is

the Cause of all the necessary Circulations in Bodies : The immediate Agent and Instrument in all earthly Things.

In a Word, the pure Æther or Fire, contain'd in Air, is the Cause of all Motion, animal, and vegetable.

This is the Opinion not only of the Ancients, but of many modern Chymists, as well as many other eminent Philosophers.

The learned Bishop *Berkely*, in his *Siris*, speaking of Air, reasons thus :

" That there is some latent vivifying Spirit diffus'd throughout the Air, common Experience sheweth ; inasmuch as it is necessary both to Vegetables and Animals, whether terrestrial or aquatic : Neither Beasts, Insects, Birds, nor Fishes, being able to subsist without Air, nor doth all Air suffice ; there being some Quality or Ingredient, of which when Air is depriv'd, it becometh unfit to maintain either Life or Flame. And this, even though the Air should retain its Elasticity ; which, by the Bye, is an Argument that Air doth not act only as an Antagonist to the intercostal Muscles.

" It hath both that, and many other Uses. It gives and preserves a proper Tone to the Vessels : This elastic Fluid promotes all Secretions ; its Oscillations keep every Part in Motion ; it pervades and actuates the whole animal System, producing great Variety of Effects, and even opposite in different Parts ; cooling at the same Time and heating, distending and contracting, coagulating and resolving, giving and taking, sustaining Life and impairing it, pressing without and expanding within, abrading some Parts, at the same Time insinuating others, producing various Vibrations in the Fibres, and Ferments in the Fluids ; all which must needs

" ensue from such a subtil, active, heterogeneous, and elastic Fluid." *Siris, Section 143.*

That this Fire or Æther is the Cause of animal Motion, Sir Isaac Newton seems to think, is past Dispute, as well as many other Things, which he affects to put as Quæries. Thus,

" Is not animal Motion perform'd by the Vibrations of this Medium, excited in the Brain by the Power of the Will, and propagated from thence through the solid, pellucid, and uniform Capillamenta of the Nerves into the Muscles, for Contracting and Dilating them? I suppose, that the Capillamenta of the Nerves are each of them solid and uniform, that the vibrating Motion of the æthereal Medium may be propagated along them, from one End to the other uniformly, and without Interruption: For Obstructions in the Nerves create Palsies." *Optics, Quæry 24.*

Which, by the Bye, was Spinning it out to a great Length; for, although he had many Times view'd this, his subtil Medium, under the Hand, in electrical Experiments; yet might he, not very improperly, be said, never to have seen it, because he did not apprehend it to be such; therefore to carry it so far, as to imagine it the Cause of animal Motion, must shew an exceeding penetrating Genius; and, though many are now of that Opinion, yet they can't think it Working so much in the Dark, because they are now *sure*, there is such a powerful subtil Medium existing.

B. Why do you think it has a Power sufficient, as well as a Tendency to communicate Activity and Motion to Fluids in general?

A. Not only from the foregoing Reasoning, and that of many considerable Authors, but as it is confirm'd by various Experiments in Electricity; such as the capillary Syphon, where, from dropping gently before it is electris'd, it will afterwards flow

flow in a Stream : Likewise the Droppings from a Spunge full of Water, which, when electrish'd, are much accelerated ; with many others.

B. Is there any particular Experiment in Electricity, which proves it to accelerate the Motion of the Blood in a human Body ?

A. Yes, one in particular, which seems to put it past Dispute ; it is an Experiment mention'd by Mr. *Rackstrow*, in his Essay, who says,—If a Person is electrish'd standing on a Cake of Resin, the Number of Pulses will be increas'd two, three, or four, in Half a Minute ; this surprising Account of it, I own, I could hardly credit, for which Reason I was determin'd to prove it on myself ; this I did by first counting the Number of my Pulses in Half a Minute, several Times, when standing on the Floor, and wrote them down in the Window.

That the Experiment might be made as accurately as possible, I kept at a due Distance from the Clock, so as not to be disturb'd in my Reckoning by hearing the Vibrations of the Pendulum ! Then, standing on the electrical Cake, the Person at the Clock gave me Notice, by naming the first Vibration, loud enough for me to hear ; and also the last : This Method of knowing the Time of only the first and last Vibration left no Room for Mistake, particularly as I repeated the Experiment several Times, which I found to answer so truly to his Account of it, that it left as little Room for Doubt ; his whole Paragraph is as follows :

“ The Circulation is increas'd by a Person only
“ standing upon a Cake of Resin, and so electri-
“ fy'd ; and the Effects are so moderate, that they
“ only serve to chear and raise the animal Spirits ;
“ for, when it acts the strongest, it will increase the
“ Number of Pulses three or four in Half a Mi-
“ nute, and, when weak, about two ; and even
“ that, as I apprehend, may prove of very great

" Service ; but what tends to the greatest Good, " are the Shocks given moderately, and with some " Judgment ; and I am well assur'd, that it will " remove many Obstructions, and be of great Use " in paralytic Cafes ; it helps Digestion, quickens " the Circulation of the Blood, provokes Urine, " and causes a freer Respiration and Perspiration. " All these I have often observ'd, and doubt not " but that many other Things, beneficial to Man, " may farther be discover'd ; such as may help in " Colic, iliac Pains, Spasms, Convulsions, Apo- " plexies, hysterick, rheumatic, and arthritic Dis- " orders." Mr. Rackstraw's *Essay*, p. 2.

For my own Part, I am thoroughly convinc'd that, as a greater or less Quantity of this Fire is convey'd into the Lungs, the Motion of the Blood is thereby either accelerated or retarded.

B. Though you seem to make it very plain, don't you think you may possibly be mistaken ?

A. Yes, most certainly very possibly, but what makes it probable that I am not, is, that as the above Experiment clearly proves the one Part to be Fact, viz. of a greater Quantity ; so the other Part is as clearly proved, by observing, that, whenever we attempt to breathe the same Air over and over again, it will by no Means serve for the same Purpose ; nor is it only unfit to preserve Life, but even common Flame, as above.

That it is unfit to preserve Life, seems abundantly confirm'd, by observing the Mortality so frequently found in Dungeons, and on Shipboard, particularly the latter, especially in long Voyages ; and, the more so, the greater the Number of Men, who are crowded under Hatches, where they are oblig'd to breathe the same vitiated Air again and again ; this, together with their salt Provision, seems greatly to increase the Mortality, which is found to lessen, when they come to Land, particularly

larly if they are not oblig'd to lodge in the Ship ; what yet more confirms the Truth of it, is, that, where Ventilators have been made Use of to convey fresh Air to their under Decks, those bad Effects seem to vanish.

The Gaol-Distemper, as it is call'd, seems like-wise to be the bad Effects of the same vitiated Air ; and, doubtless, the whole Cause of all this great Mortality is from their Breathing so much less Fire or Æther than what is contain'd in common Air.

And, altho' the Heart is indeed commonly suppos'd to be the principal Seat of all that Motion so absolutely necessary to sustain animal Life, yet, on Examination, it will appear reasonable to believe, that the Organs of Respiration may rather claim the Office of *Primum Mobile* ; for, if we trace the Subject back to its Original, we need but consider, that, during the Time of Gestation, when the Fœtus in the Womb is to be consider'd as a temporary Appendage only, engrafted on the Parent's Body, and its Nourishment and Growth scarce resembling an Animal more than a Vegetable ; the Circulation, when in that State, being perform'd, to and from it, by the Parent's Lungs and Heart, in the same Manner as it is, to and from the several Parts of her own Body ; but, at the Time of the Birth, when the same Means of Circulation is at an End, there evidently appears something wanting ; something, absolutely necessary to continue the Circulation, which the Heart alone can, by no Means, accomplish ; nor can it yet act as an Animal, till this fluid Fire, this vivifying Spirit, contain'd in Air, has found Admit-tance into the Lungs, and from thence communi-cated Activity to the languid Motion of the Blood ; for, till then, the new-born Babe continues in a Kind of lifeless Condition, but, after this Engine

is once in Motion, the increas'd Motion of the Heart immediately follows, Life is produc'd, and the whole animated Machine continues to live, so long as these two Engines continue in joint Motion, to maintain a perpetual Round of Blood and Fire; but, when once the Motion of either of them is stopp'd, the Motion of the other, depending on it, will soon cease likewise, and the Animal instantly expires.

And, tho' many Children are actually born dead, yet many others, which are quite given over as such, might very probably be recover'd, and many valuable Lives sav'd, if timely Help could be administer'd; particularly, if it were possible to form an Instrument so fitly adapted to the Mouth of the Child, as that the Air, the Nostrils being clos'd, might be that Way convey'd into the Trachea, by Ventilation, which would, in all Probability, recover it; I mean, while any moderate Degree of the Circulation is remaining.

What induc'd me to meddle with any Thing so far out of my Province, was, not only being led to it by the Nature of the Subject, but what I once heard affirm'd by a Midwife, which was, that she had many Times recover'd a Child which was, in Appearance, dead, by forcing in her Breath at the Mouth of it; which, if possible to be perform'd, by forcing the vitiated Air out of her own Lungs into the Child's, then how much rather might the Experiment succeed, if perform'd by the above Method, with fresh Air endu'd with all its active and enlivening Qualities?

Mr. *Martin* likewise, in his *Essay on Electricity*, seems firmly persuaded, that the electrical Matter will, in Time, be found very beneficial to the animal *Œconomy*; and says, "Moreover we know it has a considerable Influence on fluid Substances: A glaring Instance is that of the *Syphon*

" Syphon and Sponge ; by which it appears, that Fluids in Motion have their Motions greatly accelerated by the electric Virtue : Thus, if a Vein be open'd in a Person electrify'd, the fluent Blood will project to a much greater Distance than it would otherwise do : And is not this a promising Indication of some great Use, that may be one Time or other deriv'd to the animal Œconomy from Electricity ?"

He likewise informs us, that, if an Attempt be made to electrise a Person when ill with the Small-Pox, it proves of no Effect.

B. It should seem natural then, from what you have been pleading for, that if a Person just strangled, suffocated, or by any other Means had suffer'd a Collapsion of the Lungs, so as to be in Appearance dead ; if a Pair of your Ventilators could be readily apply'd, he might be recover'd.

A. That many who die suddenly might be recover'd, if the above Method were as practicable as it appears to be, and were timely apply'd ; and also that there is a most astonishing enlivening active Quality in the ætherial Spirit contain'd in Air, on which Life immediately depends ; seems abundantly confirm'd by the three following Experiments, mention'd by Mr. *Derham*, in his *Phys. Theol.* under the Article *Respiration*.

The First of which is an ingenious tho' cruel Experiment, of the renown'd Dr. *Hook*, before the *Royal Society* ; who cut away the Ribs, Diaphragm, and Pericardium of a Dog ; also the Top of the Wind-pipe, that he might tie it on to the Nose of a Pair of Bellows ; and, by Blowing into the Lungs, he restor'd the Dog to Life ; and, then ceasing Blowing, the Dog would soon fall into dying Fits, but by Blowing again he recover'd ; and so alternately would die and recover for a considerable Time, as long and often as they

chose to repeat the Experiment. *Philos. Trans.*
N° 28.

Another Experiment of this Sort was made by Dr. *Walter Needham*, before Mr. *Boyle* and others, at *Oxford*; who hang'd a Dog, so that the Heart ceas'd Moving, but hastily opening him, and by blowing Wind into his Lungs, put the Blood in Motion, and by that Means the Heart, and so recover'd the Dog to Life.

The third Experiment was made by Dr. *Croon*, of *Gresham College*, before the *Royal Society*, on a Pullet, which he strangled, so as no Sign of Life appear'd, but by blowing Wind into the Trachea, and so setting the Lungs a Playing, brought the Bird to Life again.

B. Though this must be allow'd to be most wonderful, yet as we are inform'd by the greatest Philosophers, as well as many modern Chymists, that *Aether*, or the ætherial Spirit, universally dispers'd, is the Cause not only of muscular Motion, but of all the Motion in the Universe, and as all this seems so probable, we have not so much Reason to wonder at all these lesser Effects; however, such Things as these must be sufficient to inform us, that something more is perform'd, than what is commonly apprehended by most, when they simply, and in the common Phrase, speak of Blowing Wind down the Throat.

Surely as this ætherial Medium is observ'd so absolutely necessary, not only at the first Formation of the Fabric, but likewise all the Time of the Increase, or, if I may be allow'd the Expression, all the Time of its Building up; it must naturally discover a constant Tendency to the Repairing of many of the Breaches that may casually happen to it; which Repairs, if your electrical *Aether* were capable of performing, this perhaps might prove more convincing, that it was the

very

very etherial subtil Medium of Philosophers, than all your former Reasoning and Experiments put together.

A. Nothing can be more plainly discover'd than the salutary Effects of Æther, even of that Portion contain'd in Air, if we were only to consider how much a fine and pure Air contributes towards the Recovery of lost Health: And if electrical Æther, and the universal Æther, or subtil Medium of Philosophers, are the very same identical Substance; that then electrical Æther must necessarily, as you observe, discover a natural Tendency to heal; and that it does actually discover such a Tendency, the following several Cases seem clearly to prove: And, to say the Truth, it was Accounts of some very remarkable Cures mention'd in the public Papers, which induc'd me at first to get an electrical Apparatus, and with no other View than to make Experiments of that Kind, being fully persuaded, that so extraordinary a Phænomenon was never discover'd to us, but to answer some very valuable End; and, tho' I began Experiments of this Kind at all Adventures, and at the greatest Random possible, yet I had the Pleasure and Happiness to succeed, far beyond my Expectation, and will therefore give you a faithful Account of various Cases, wherein I have had the Opportunity to find electrical Treatment of Use.

Electricity apply'd to the Cure of bodily Disorders.

i. **A** Servant of Mr. Tilt, of Bromsgrove, ten or twelve Miles from Worcester, afflicted with a violent and constant Head-ach for near a Fortnight, was twice electriss'd, at Half an Hour distant from each other, and cur'd; who, coming again that Day Fortnight, declar'd he never had any Return of it afterwards.

The Manner of the Operation was a few light Shocks in the Head.

2. Mr. *Robert Soule*, in *Worcester*, troubled with a Sciatica for many Years, was cur'd at one Operation; after which, I did not remember to have seen him for near a Year, at which Time he declar'd, that he had ever since been free from it.

The Operation was Shocks likewise, convey'd to the Part affected.

3. *William Jinks*, of the Hospital in *Fryer-street, Worcester*, troubled with a Rheumatic Pain in the Knee for eight Years, and, at some Times, so bad, as to have but little Rest Day or Night, particularly when in Bed; but, after Making Use of the electrical Machine a few Days, was eas'd of his Pain, so that he could rest well; and, tho', before, it was with Difficulty that he walk'd with a Staff, yet was, soon after, able to go without it.

The Operation was sometimes Shocks, sometimes simply Drawing off Sparks, which is commonly perform'd thus:

Let the Person stand on the electrical Cake, and another, standing on the Floor, bring an iron Rod, or a Finger, near to the Part affected, at which Time Sparks of Fire will be seen to dart from it.

4. *John Broome*, having, for some Days, complain'd of a very bad Pain just above his Eye-brow, which, he said, was much like the Head-ach, only fixed to that particular Part, was cur'd in a few Minutes.

The Operation was Shocks at the Part affected.

5. Mr. *Higgins*, in the *Lich-street, Worcester*, troubled with a partial as well as periodical Head-ach for near six Weeks, from the Top of his Fore-head, or right Temple, down to his Ear, which commonly began at Five or Six o'Clock in the Evening,

Evening, and held till he went to Bed, was cur'd in a few Minutes.

The Operation was simply Drawing Sparks from the Part affected.

6. *Margaret Dancock*, near *Sidbury-gate, Worcester*, was afflicted with an almost constant as well as violent Pain in the Hinderpart of her Head, for near three Quarters of a Year; but worst of all, when she first lay down in her Bed, being then so intolerable, she could not forbear Shrieking; having made Use of all Means in her Power, to no Effect, was very soon reliev'd of the Violence of the Pain, by being electris'd once a Day, and, after continuing it some Time longer, declar'd herself perfectly cur'd.

The Operation was Drawing Sparks, and some light Shocks, convey'd to the Part affected.

7. The same Person had been afflicted with the most violent Cramp in her Legs I ever heard of, which Disorder seiz'd her before she was twenty Years of Age, and continu'd till the Operation was perform'd, when she was upwards of Seventy. This was most violent always when in Bed, at which Time she was forc'd to tumble out on the Floor, and there continue till it was over, were the Weather ever so sharp, and this, sometimes, twice or thrice the same Night; the violent convuls'd muscular Parts forming themselves into distorted Ridges, attended with exquisite Pain, bursting the small Blood-vessels, which afterwards appear'd of a livid Hue for a considerable Time: This was entirely cur'd in a few Days.

The Operation was Shocks only, and perform'd, once a Day, thus: Having taken off her Shoes, she put one Foot on the End of the Chain which came from the charg'd Phial; then, putting the lower End of a large Wire, or small iron Bar, to the other Foot, and, at bringing the other End to the

the excited Apparatus, the electrical Matter was convey'd thro' both Legs at the same Time. By Experiment IVth.

8. Another, who had ridged Knots in the Thigh, in Form like what appear in violent Cramps, tho' much more soft, and less painful : Those were entirely dissipated, in a Minute or two, by simply Drawing Sparks from the Parts affected.

9. *Mary Bradley*, of St. Peter's, Worcester, very much afflicted with a Rheumatic Pain in her Shoulder and Arm, for near three Quarters of a Year, but mostly when in Bed ; nor was she able to dress herself : Her Disorder was such, as seem'd out of the Power of Medicine to cure, having been an Out-patient of the Infirmary for four Months, without Success ; was, by Help of the electrical Machine, soon reliev'd of her Pain, and able to do her Business ; and, tho' it is now a Year since, she still continues easy and well.

The Operation was sometimes by Shocks, sometimes Drawing Sparks from the Part affected.

10. *Anne Thomason*, in Little Fish-street, Worcester, was troubled with a Fistula near the inner Corner of her Eye, which healed, and broke again seven Times, yet was fearful of putting herself into the Hands of a Surgeon, because she was inform'd it would be necessary to make an Incision in her Nostril.

The last Time it heal'd, it continu'd well a considerable Time ; after which, it began, at the same Place, with a very small Swelling, and continu'd growing larger, till it was as big as a Filibard ; at which Time one of her Neighbours advis'd her to try the electrical Machine, which she did, and soon found it grow less and less, and so continu'd doing, till it was entirely dissipated, and has continu'd well for more than two Years, without

out the least Symptom of any Return of the Dis-order.

The Operation was simply Drawing Sparks from the Part affected.

The following Account was written by the Gentleman himself, on whom the Cure was perform'd :

II. "A Gentleman in Worcester had the Mis-fortune of running the Point of a Bodkin into the Inside of his Hand, near the fore and middle Fingers : The Wound was so small, it was scarce to be seen the fourth Day, and afterwards not at all, and was, in Reality, no more than the Prick of a large Pin ; yet, in three or four Days, a Swelling came on, not only in the Palm, but likewise on the Back of the Hand.

" The fifth Day, upon a greater Uneasiness in the Hand, a Surgeon was call'd in, who, during the Space of three Months, apply'd Pultices, Fomentations, the strongest drawing Plaisters, &c. both to the Inside and Outside of the Hand, yet all to no Purpose : As no Medicine would affect the Swelling, a Caustic was apply'd, but with no more Success than all the other Means ; whenever this inveterate Swelling was touch'd or press'd, it left a Dent in the Back of the Hand, like what we see in the Flesh of dropsical Persons.

" The Swelling still continu'd, and no Alteration, nor Likelihood of any. Upon Reading the Gentleman's Magazine for 1749, he observ'd great Things had been done by Means of Electricity ; he therefore applied to one in the Neighbourhood, who had an electrical Machine, and was electrify'd twice on the Inside of his Hand, at the Bottom of the middle Finger ; in four Days it broke there ; he was then electrify'd on the Back of the Hand, opposite to the Inside ; just at the same Space of Time it broke on the Back,

" and discharg'd a good Deal of Matter, and, in
" about three Weeks, heal'd."—This Operation
was simply Drawing off Sparks.

12. The very same Gentleman, about two Years after, had the Misfortune of a Mortification, which began in his Toe, and gradually increas'd, notwithstanding all the best Methods were us'd which could be thought of.

As the Use of the Machine had so good an Effect on his Hand, I prevail'd with him to try it twice on his Toe.

Soon after this the Surgeon saw me, and ask'd me, when I electrify'd Mr. W——'s Toe; I told him, two or else three Days before: He reply'd, the Mortification was stopp'd. But, notwithstanding this promising Aspect, together with the salutary Effect on his Hand beforementioned, he, like one infatuated, neglected the Use of those Means, and the Mortification came on again; which he suffer'd to increase very much, before he could be prevail'd on to make Use of it again. This caus'd me to tell him, if he would not make Use of it in Time, I should much rather he would give over all Thoughts of it; but he seem'd, notwithstanding these Neglects, to have a very great Opinion of it; that he dream'd of it, and that he must and would be electrify'd again: Accordingly he got an electrical Machine into his House, though I must own, by that Time, I had not much Hopes of its being of any considerable Service to him; however, Electricity was again made Use of, and the electrical Virtue to pass, with some Violence, thro' the mortify'd Part.

The next Morning, when it was opened, the Surgeon seem'd astonish'd at seeing such an Alteration, and ask'd Mrs. W——, who stood by, what had been done to it? She desir'd to know why he seem'd so surpris'd, and if he thought it better?

better? Better, yes, reply'd he, by fifty per *Cent.* for now it discharges good Matter, and still desir'd to know what had been done to it: She told him, nothing but electrify'd, and said, that that must needs be the Cause of the sudden Change for the better; and, though he told her he could not believe it was capable of producing such Effects, yet he order'd, that, whatever had been done, might be repeated; it was accordingly twice electrify'd that Day; and though, next Morning, it had not discharg'd quite so much as before, yet she said he told her, there had been more good Matter discharg'd, at those two Dressings, than there had been for five or six Weeks before, and desir'd it might still be continu'd, not twice, but once a Day.

As the Disorder was at this Time far advanc'd, and as all other Means prov'd ineffectual, if finding it still yield to this Sort of Treatment would be thought something surprising, how much more so, to find, that, after so many favourable Circumstances, he should refuse to make Use of it again? But this was the very Case; and his Reason was, it gave him Pain, which in all Probability was, in that Disorder, no bad Symptom.

Had he pursu'd it at first, it might, in all Probability, have had as salutary an Effect as before on his Hand; for, in all Likelihood, if that had been neglected much longer, that too must have mortify'd, because it appear'd as if the Circulation was nearly ceas'd, and Medicine not to have the least Effect; but, as soon as the Palm of the Hand was electrify'd, the Fluids, which were before almost at a Stand, began then to move, as if they had been just inspir'd with new Life; for, from that Time, the very Part gradually arose, came to a Head, and broke.

And, notwithstanding all the Appearances above-
2 mentioned,

mentioned, this might be thought to be nothing more than a lucky Turn of the Disorder, which happen'd just at that Time ; yet the Electrifying the Back of the Hand afterwards, and which, as the Gentleman himself informs us, had the same Effect, and brought it to a Suppuration in the very same Space of Time, is not only a plainer Proof that Electricity was the Cause, but also, in some Measure, seems to promise still greater Advantages to Mankind, when more frequently apply'd to Disorders incident to the human Body, and when Time and Experience shall have pointed out the particular Disorders which seem best adapted to such electrical Treatment.

The Operation was Shocks only ; those were brought from the Toe, outwardly, through the Dressing and several Folds of Flannel, by bringing the Chain from the Coating of the Phial to the Knee, then laying one End of a large Wire, or small iron Rod, to the Extremity of the Toe, and bringing the other End of the Rod to the excited Apparatus. The Circuit being thus form'd, the Shock was given, and the Circulation perform'd, so as to pass outwardly from the diseas'd Part.

N. B. The Fire could be plainly seen, between the End of the small Rod and the flannel Dressing at the End of his Toe, every Time the upper End of the Rod was brought to the excited Apparatus.

13. A young Lady had the Misfortune of a Strain of the Knee-joint, or rather the crural Ligament, together with a low-spirited Disorder, perhaps hysterical ; this seem'd to be heighten'd by the other Misfortune, and increas'd to that Degree as to bring on a Kind of fainting Fits, which sometimes follow'd each other so fast, as to have two or three of them successively. Those, though they were in Appearance exactly like swooning Fits, yet, in this seeming insensible State, she could hear

hear and understand what was saying or doing; but had no Power to stir.

This Disorder seem'd as stubborn as the other Malady; and the Surgeon was of Opinion, that, so long as it continu'd, the Lameness would grow worse, which accordingly happen'd.

As all Attempts had hitherto prov'd unsuccessful, she try'd the Bath; but to little Effect.

About three Quarters of a Year after the Accident happen'd, electrical Treatment was advis'd; and accordingly made Use of. When she first came to me there appear'd no Swelling, but, on the contrary, the muscular Part of the Leg much fallen away; a continual Coldness also attended the Foot.

Electricity, for the first Month, seem'd to have but little Effect; but, the second, there was a visible Alteration for the better; the next Month after, it mended surprisingly; so that she began to exercise it, by first attempting to walk a few Steps each Day, without Crutch or Staff, which, as she inform'd me, she could perform without Pain. I advis'd her to find out the Number of Steps she could accomplish without Pain; and then to add one to the Number each Day, which she did; and afterwards two each Day; thus it continu'd, mending in the same surprising Manner; this second Month, particularly after leaving off the cold Bath: At the End of the next Month, which was the third after it began to mend, she was grown so well as to attempt the going down with a Country Dance; and began to think of leaving off the Use of Electricity.

Finding she did not attend as usual, I sent her a small Epistle, to inform her; that, although she might think herself nearly well; yet I could not help thinking, that what had been so long and so constantly practis'd, ought not to be left off all at once;

once, for Fear of a Relapse ; but, notwithstanding this, she came not again, till she was convinc'd that what I suspected was coming on her, for she soon found a very visible Relapse, and was oblig'd to return to the Use of Æther again, and, when she had recover'd the Relapse, to leave off the Use of it more gradually * : But when she left it quite off, it appear'd a finish'd Cure, of not only the Lameness, but of the Fits likewise, and the Coldness of the Foot ; the Leg also, which had been in a Kind of pining Way, appear'd as full of Flesh, and as tight and well braced as the other.

The Operation was Shocks chiefly for the grand Complaint, but, to help the Fits, the Manner in which it was perform'd was thus :

To a Chamber, at four Rooms Distance from the Machine, were Wires convey'd, supported with silken Strings, where the young Lady sat in a Chair, each Leg of the Chair being supported with a Cake of Resin ; her Feet were also supported with another large Cake, so that a Communication, of the electrical Æther, with the Earth, was entirely cut off ; thus she sat supported for Half an Hour at least, in which Operation nothing is felt ; the Whole of which appears to be perform'd by Respiration only.

The Shocks were always first perform'd before she sat in the electrical Chair †, and perhaps fifty, sixty, or more every Night ; at each Shock, the Fire was made to pass through that Part of the Knee where the Disorder lay ; as to the Operation, she, with the Assistance of a Maid-servant, could,

* After the Relapse, the Progress of the Cure was much more tedious than before ; and it was four or five Months longer, e're the Use of Electricity could be quite left off.

† Because, sometimes after Heating by long Friction, the Globe acts not strong enough to cause a Shock.

with proper Directions, perform it herself, thus : The Condensing-phial was suspended on a convenient Part of the Apparatus of Wires, and, a Piece of Chain being fasten'd to it, the other End of it was brought to one Side of the Knee ; then taking a Wire in the other Hand, one End of which being laid to the opposite Side of the Knee, the Shock was produc'd by guiding the other End of the said Wire to any Part of the excited Apparatus ; by which Means the electrical Æther pass'd through the Part affected, by being made a Part of the Circuit *, as at Experiment the 4th.

14. A young Lady was very much afflicted with Fits for near seven Years; which seiz'd her without giving any Warning, and threw her flat on her Face ; for which Reason it was dangerous to go near the Fire, or even walk abroad by herself, notwithstanding she scarce ever, excepting once, continu'd in that insensible State so long as a Minute, and oftentimes not half so long.

Their Returns were very frequent, sometimes twice in a Day, though sometimes perhaps, after beginning with a fresh Medicine, she would find some Relief ; but nothing could be found which was likely to prove an absolute Cure; till Electricity was advis'd and comply'd with : What render'd the Cure the more difficult, was a very great Coldness in the Feet, and Physicians were of Opinion; that the Fits would not be easily conquer'd, except the Coldness of the Feet could be first remov'd ; this I did not know till afterwards; but, as she told me, it sometimes seem'd to begin in her Stomach, I was not much at a Loss to know how to convey the Fire through both Stomach and Head at the same Time ; for, whatever be the Part

* Some like Operations were made Use of, to convey it to the Knee, Leg, and Foot, all at once.

affected, and I have a Desire to pass the Fire through that particular Part, it is only to form a Circuit as in the Manner describ'd by Experiment the 4th, and to cause that particular Part to make a Part of the Circuit, and it is done: And since it is equal, by the same Experiment, whether the Circuit be long or short, the most eligible Way must be to have her stand upon the Wire or Chain coming from the leaden Coat of the Condensing-phial, and then to compleat the Circuit by laying another Wire to any particular Part of her Head, by which Means the Fire will be convey'd to that particular Part of it; for, as the Line of Direction of the Fire is always the shortest possible, by always taking the nearest Way, as is evident by that Experiment, it may be guided to a very great Exactness; this being the Method which was taken, and the Fire going through the Feet, as well as the Stomach and Head, all seem'd to receive an equal Share of the Benefit, and a compleat Cure was effected, both of the Fits and Coldness of the Feet; and both appearing to be gradually conquer'd at the same Time.

The Operation was Shocks only; and the subtil Medium perform'd the Circuit from the Sole of the Foot, through the Crown of the Head.

Concerning Motion being communicated to extravasated Blood.

The Experiment was this:

15. A Person having a dark livid Spot under the Eye, from a Blow three Days before; it was, in less than a Quarter of an Hour so taken out, or rather the Circulation so carry'd on, that there only remain'd a faint Mark where it had been.

The

The Operation was simply Drawing Sparks from the Part affected.

16. The same Person had a Swelling between the Neck and Shoulder-blade as big as an Egg, and nearly as hard, which had been growing to that Size for several Years: She had not been many Times electrish'd before it began to soften, and, soon after this, to discharge a thin Kind of Humour thro' a small Orifice, and continu'd discharging, and gradually softening, till it was entirely dissipated.

The Person call'd it a Wen; but I thought it much harder than they commonly are.

These Kind of Operations are best perform'd by electrising the Person on a Cake of Resin, and another standing on the Floor, to bring an iron Rod, large Wire, or else his Finger, so near the Part, that the Sparks may be drawn from it; and this to be repeated each Day, for five or six Minutes.

17. A young Woman, by Drinking too freely at a cold Spring, when over-heated, was afterwards seiz'd with a feverish Disorder, which continu'd for a Quarter of a Year, or more; at which Time a Number of red Spots began to appear on her Arms, out of which seem'd to breathe such Effluvia, as soon condens'd into a thin, dry, crusty Substance, that appear'd rather as Scales than Scabs, and these from her Elbows down to her Fingers: This Disorder continu'd on her for near three Years, which the first and second Winter very much lessen'd, but the third Year it continu'd the same in the Winter likewise.

The next Summer she began to make Use of Electricity, and, in three Weeks or a Month, most of those Scales disappear'd: Before this, she had a remarkable dry Hand, but, after these Electrifications, as remarkably moist, insomuch as to be troublesome when at her Needlework.

The Operation was simply Drawing Sparks from the Parts affected, once a Day.

18. *Elisabeth Bund*, near the *Old Hills*, in the Parish of *Powick*, a few Miles from *Worcester*, had, for fifty Years past, been afflicted with severe Fits; which, like an Epilepsy, gave her no Warning of the approaching Danger, but threw her down in an Instant on the Ground, and continu'd her in a State of total Insensibility for a considerable Time: As the Number of Attacks were sometimes twice, and sometimes thrice in a Day, she found it extremely dangerous to go near either Fire or Water; from the First, by being too near it when the Fit came, she has twice been a dreadful Sufferer, having two of her Fingers burnt off, and her Face and Neck greatly disfigur'd by the Fire, during her insensible State.

But being in *Worcester*, the latter End of the Year 1752, and accidentally relating her unhappy Situation to me, I was strongly inclin'd to try if the electrical Shock might prove of any Efficacy in such a Case.

She desir'd earnestly to make the Trial, as she had try'd other Means in vain; and found, upon her Return Home, such a surprising Amendment in herself, as encourag'd her to come to *Worcester*, from that Time to the Year 1754, as often as she had an Opportunity, to repeat the Operation; the Consequence of which was the gradual Decrease of an inveterate Head-ach, which attended her Disorder, and, at last, the total Cessation of the Fits themselves; for, instead of being seiz'd with them twice or thrice a Day, after she had began these electrical Operations, she had no more than about four of them, and those greatly weaken'd, from that Time to *Christmas*, 1753; and as, since that, they have not return'd again, there is sufficient

cient Reason to hope they never will. Sign'd September the 12th, 1754.

The Operation was Shocks chiefly, and, in those, the Fire was guided, for the most Part, thro' the Arm and Head, for Want of better Knowledge at that Time; for, if a similar Case were now to offer, I should be more inclin'd to pass it quite thro' the whole Body as well as the Head, as at Case the 14th.

19. A young Gentlewoman, of the Parish of Clifton, about ten Miles from Worcester, some Time after, being recover'd of a Fever, was seiz'd with violent Hysterics; the Effects of which were so bad, as very soon to deprive her of both Memory and Understanding; and so continu'd for a considerable Time, notwithstanding the best Advice of two eminent Physicians.

In this melancholy State she was brought to Worcester, to try the Effect of Electricity; I told the Person who brought her, it would be necessary to perform the Operation, at first, in a very slight Manner, lest it should startle her, and by that Means so intimidate her, as to prevent her Coming again; but she reply'd, there was no Danger of that, for she could not remember Half an Hour to an End.

As the Head was the Part affected, I guided the Fire chiefly to that Part, in as plentiful a Manner as I well could, and caus'd it to pass quite thro' several Times each Day, so long as she staid in Town, which, tho' scarce a Week, yet it seem'd to have the desir'd Effect; for altho', before she came to Worcester, she could not remember Half an Hour to an End, yet, soon after her Return Home, she could remember most remarkable Things she saw done in Worcester; and not only her Memory, but her Understanding also return'd, and she very soon became perfectly well.

The Operation was sometimes Shocks, sometimes Drawing off Sparks from the Head.

20. *Mrs. Higgins*, in the *Lich-street, Worcester*, troubled with a low-spirited hysterical Disorder, was afflicted also with a Coldness in the Feet for many Years: From this Coldness in the Feet, a Coldness could be plainly perceiv'd to move gradually quite up to her Head, in Half a Minute's Time, or less, which would then appear like a Palsy in her Head; and, very soon after, such a Chattering of the Teeth would ensue, as we sometimes behold in the most violent shivering Fit of an Ague; from thence this Shaking proceeded to her Arms, and all over her Body; and, as Hysterics, mimic most other Disorders, the Shaking was so violent, and appear'd so active, as if it was rather inclin'd to mimic the St. *Vitus*'s Dance than the Palsy.

The Returns, or Fits of this shaking Disorder and low-spirited Complaint, were very frequent for upwards of ten Years, notwithstanding all the Means made Use of; but, after being electris'd once a Day, in less than a Fortnight's Time, went entirely off; and, by continuing the Use for some Time longer, was much higher in Spirits, and the Coldness of her Feet quite cur'd.

The Operation was sometimes Shocks, sometimes simply Drawing off Sparks; but the longest Operation was simply Electrifying, *viz.* Standing on the electrical Cake only, and Breathing the celestial Fire, which, perhaps, was performed for the greatest Part of Half an Hour.

21. *Esther Hopkins*, of *Tedney near Whitbourn*, about seven or eight Miles from *Worcester*, was troubled with a very painful Swelling in the Ball of her great Toe for some Years; the Pain was greatest of all, when in her Bed; having, in vain,

made

made Use of other Means, came to Worcester to try the Effect of Electricity.

After the first or second Operation, the Pain was much abated; and she told me, with Pleasure, the next Morning, she had slept comfortably, and had more Rest than in any Night for a considerable Time before; and, after continuing the Use of it for a small Time longer, the Swelling gradually asswag'd, and the Pain left her.

The Operation was Setting her on a Cake of Resin, and, after conveying the electrical Æther on her, a Finger, or Piece of Metal, was brought so near to the Part affected, as to draw off Sparks. — This is oftentimes call'd, simply, Drawing off Sparks.

22. *John Webb*, in *Fish-street, Worcester*, seventy Years of Age, was troubled with a very painful Disorder in his Feet, for ten or twelve Years, which, he had been inform'd, was the Gout; a general Coldness also of the Feet attended the Disorder, which was sometimes so great, that, if he sat still in cold Weather, he was almost insensible of the other Pain; and, if he warm'd them by the Fire, it caus'd them to rage in such a Manner, as scarce to be borne; and also in Bed, when any Warmth came on, especially in the Ball of one of his great Toes, which was so intolerable, that, many Times, after two or three painful Hours, he was forc'd to get up, and perhaps sit starving with Cold in a Chair, being scarce able to walk, for the Greatness of the Pain: If he made shift to stay in Bed, to make it tolerable, he was oblig'd to prop up the Bed-clothes with his other Foot.

The Nails of his Toes, very frequently, dropp'd off all at once, if he did not prevent them, when they were become loose, by pulling them off; the Toes in general appear'd of a livid Hue, and the Circulation was so much retarded in the whole Foot,

Foot, as to produce Symptoms of a Mortification ; large black or dark livid Spots were frequently form'd on the Top and Sides of his Feet, and at the Ends of his Toes ; those, when they first came, were exceeding painful, and, at that Time, he durst not much tamper with them ; but, in some longer Time, they grew quite dry and hard, and then he could cut them out with a Penknife, and, perhaps, without making them bleed ; but, if he attempted to open them, before they were grown dry, they continu'd sore for a long Time ; these were so frequent, and so painful, particularly at the End of his second Toe, he had sometimes determined to have it cut off, or, at least, the upper Part of his Toe : Besides these, he had another Complaint in his Heels, which were generally puff'd up like blown Bladders.

Every one of these Complaints, by being electrish'd once a Day for some Time, and afterwards twice a Week, gradually decreas'd ; and are now * so far conquer'd, as to have no painful, restless, and tedious Nights, no Nails dropping off as usual, no Coldness in the Feet, nor bloated Heels, no intolerable Pain in the Ball of the great Toe, no more Signs of Mortification ; but the Blackness of the upper Side of the Toes are changing to their natural Colour, and the chief Remains of Complaints are, now, rather a Soreness or Tenderness in the Feet, attended sometimes with a Tingling, which is probably the salutary Effects of the accelerated Motion of the Blood ; as when any particular Part by being press'd or bound too hard, the Motion of the Blood has been some Time retarded ; after which, at removing the Obstruction, when the Blood goes on again, we frequently, at such Time, find a Tingling.

* Sign'd February 20, 1756.

This perhaps might be one of the best of Symptoms.

Quæry, Whether, instead of the Gout, the Foundation of all those Complaints were not a too languid Motion of the Blood, particularly in the Feet; for, although such a Complication of Disorders, yet each one, in Appearance, was the Effect of such an undue Circulation; and what seem'd to confirm it, was, that, when the Motion of the Blood was accelerated, which was known by his Feet growing warmer, every one of the other Complaints mended as it were together, or all at once.

The Operation. Sometimes at first, when at worst, simply Drawing Sparks, but afterwards chiefly Shocks; and, as the Disorder lay altogether in the Feet, the Method was, to bring the Chain from the Phial to the Part affected of one Foot, and then lay one End of a Wire or small iron Rod to the Part aggrieved of the other Foot, bringing the other End of the Rod to the Gun-barrel, or other Part of the excited Apparatus; and the Shock succeeded, and the Circulation was perform'd the nearest Way through the Patient, from one metallic Body to the other; which, in such a Case, must be up one Leg and down the other, of which the Knees were very sensible.

23. Mr. *Joshua Wade*, in *Pershore*, nine Miles from *Worcester*:

Troubled for seven or eight Years with a painful Disorder in his second Toe, and though as tender as a Boil, yet was there nothing to be seen; the Pain was so great, particularly in Walking, he was determin'd to have it cut off at the first Joint.

This troublesome Malady was cur'd at one Operation, which was perform'd by electrifying him on a Cake of Resin, and with an iron Stile drawing Sparks from the Part affected.

24. Mr.

24. Mr. *Edmund Yeates*, of *Hennick's-hill*, near *Worcester*, afflicted for two or three Months with a violent Pain in the lower Part of his Back, Loins, Hip, and down the Side of his Thigh ; was cur'd with a few of these electrical Operations, which were perform'd by conveying Shocks to the Parts affected.

25. Mr. *Bibb*, of *Hennick's-hill*, troubled with a violent rheumatic Pain in his Arm, which had continu'd ten or twelve Years, particularly when in Bed ; this was sometimes so intolerable, as to cause him, in a Kind of Frenzy, to strike it with Violence against the Bed-post ; and by Degrees he had brought himself to such a Habit of striking it, that he imagin'd it asswag'd the Pain :

Was cur'd by the same Kind of electrical Treatment, as above, viz. Shocks convey'd to the Arm.

26. A Person in *Mealcheapen-street*, *Worcester*, had, within the Space of two or three Years past, several Attacks of the Gout, since the first of which, he had always a Stiffness and Pain in the Joint of one of his great Toes, and for a considerable Time in both, particularly if he walk'd much ; was quite cur'd with a few of these electrical Operations, which were perform'd by setting him on a Cake of Resin, and so electrising him, while a Person on the Floor brought his Finger so near to the Part affected, as to cause the Sparks of Fire to burst from it.

27. *Elisabeth Taylor*, of *Hennick's-hill*, near *Worcester*, troubled with so severe a Head-ach, that it was thought to proceed from a Fever in the Brain ; having baffled all the Efforts of Medicine for eleven Years, was cur'd by Means of Electricity in a few Weeks.

The Method of Treatment was by conveying the electrical Æther through her Head, by Way of Shocking.

28. The same Person, after taking Cold, was seiz'd with a sore Throat, which continu'd growing worse for the Space of six Days ; at which Time she attempted to swallow a Bit of Bread, after it was soak'd in her Tea ; but, the Task proving too hard, it caus'd her to retch and throw up the Tea she had been drinking : The same Morning she came to Town to try the Effect of Electricity, and was so much mended by the Time she got Home again, as to eat some boil'd Mutton ; and continu'd mending so fast, that two more of those Operations made a perfect Cure on her, excepting a small Hoarseness, which continu'd something longer.

The Method of Cure was thus :

One End of the Connecting-wire or Chain being brought to one Side of her Neck, at some Distance from the Part affected, a small iron Bar was laid as far on the oppolite Side ; then, at bringing the other End of the Bar to the excited Apparatus, the electrical Æther, as usual, pass'd through it in a Right-line, from one metallic Body to the other ; by this Means it is very easy to guide it through any particular Part.

29. Having observ'd the great Efficacy of electrical Æther, in soon relieving most Kind of Inflammations, I was very much inclin'd to think the same salutary Effects would appear, when apply'd to the St. Anthony's Fire ; but, when a Case of that Sort offer'd, the Inflammation was so great, that, at first Sight, I almost despair'd of Success.

About the Middle of the Day I had the first Trial, and, before Night, the angry Swelling was much appeas'd, and in a few Days quite cur'd.

The Operation was simply Drawing off Sparks, with a Finger or an iron Stile, while she was electrified on the Resin.

30. Mr. Perkins, Surveyor of the Roads, a

Year or two ago, had a slight Touch of what he thought to be the Palsy, or something near a-kin to it ; for, all on a Sudden, his Arm dropp'd down as effectually as in any paralytic Stroke, but by rubbing it, the Use of it was again soon restor'd.

The same Day he had another, and, in some little Time after, he had a Third, which still, after it had been well rubb'd and chaf'd for a Time, became so well again as to have the Use of it, particularly at the upper and middle Joint ; but the lower Part of it was by no Means so strong as before, nor could he have wrote his Name, if he might have gain'd the *Indies* by doing it : After this, he had a Desire to try the Effect of the electrical Shock, which reliev'd him so effectually as that he was very soon perfectly well again ; the Operation was Shocks in the Arm.

31. The same Person had lately a much worse Stroke of the same Kind ; all the right Side was so affected, that he could not walk without the Assistance of two to support him ; when it first happened, he was out of Town, so that it was two or three Days before he could apply for Help again the same Way : After he had made Use of Electricity two or three Times, he was able to walk with the Support of one only ; and, in a Fortnight or three Weeks, without any one to assist him, and soon became well again.

The Operation was perform'd thus :

First standing with his right Foot on the Connecting-line, coming from the Condensing-phial—then, at bringing a Finger of the right Hand to the Apparatus, the Shock was given, and the Circuit of Æther continu'd from the Foot, the nearest Way through the Body, to the Arm and each Finger ; this was several Times repeated.

32. *Elisabeth Toldervy, Servant to Mr. Squire, in Worcester :*

Troubled

Troubled for ten or eleven Years with an uncommon Disorder, which she call'd the Cramp : This began indeed something like the Cramp, particularly in her Legs, but very soon feiz'd her in her Breast and Arm, in a different Shape ; and was as follows :

After the first Beginning of the Fit, which was under her left Breast, it darted from thence to her Right, and back again to her left Breast and Shoulder ; and then down to her Elbow, Wrist, and Joints of her Fingers, which were instantly so contracted, that, if she had not Time to catch up a Handkerchief, &c. to grasp in her Hand, the Nail of the Forefinger would oftentimes so wound the Thumb, during the Time of the Fit, as to cause the Blood to run down ; nor could the Finger which thus wounded the Thumb be remov'd, till the Fit was gone off : The Elbow also was not only contracted, but that Contraction, in Conjunction with that of her Wrist, twisted and drew her Hand behind her, turning it up again to the same Shoulder : Those Fits continued sometimes, for near Half an Hour, with exquisite Pain : The Times of Interval were very uncertain ; sometimes perhaps near a Month a-part, at other Times, twice the same Day.

The Force of the Contraction was so great, that it was out of the Power of two Persons, standing by her, to hinder the Arm from being drawn behind her, notwithstanding they us'd their utmost Endeavours.

This inveterate Disorder which would yield to no Medicine, soon gave Way to electrical Treatment, and in a few Weeks quite left her.

Operation. First standing on the Connecting-line coming from the Condensing-phial, then, at bringing a Finger of the Hand affected to the Apparatus, the Shock was given, and the Circuit of Æ-

ther continu'd from the Feet the nearest Way, thro' the Body, to the Arm and Fingers ; this was several Times repeated to each Finger.

33. *Susanna Rea*, in *High-street, Worcester*, troubled with a Bronchocele, for ten or eleven Years, which began on the right Side of her Windpipe, and gradually increas'd over it, till at last the Neck was eighteen Inches and an Half about, and the Swelling extended till it was more than half Way round it.

This Swelling was electris'd, and Sparks drawn from it once a Day for three Months or more, in which Time it was not only considerably lessen'd; but, if the Muscles were strain'd by Coughing, or otherwise ; remarkable oblique Channels were instantly form'd at the largest Place of the Swelling, as if one Part had been separated from the other.

After this, those electrical Operations were neglected for many Months, but she has for more than three Months past attended again ; and, now, instead of Drawing off Sparks as before, the Operations are perform'd by Way of Shocking, which appears to be the most effectual Method.

Swellings of this Kind are the most obstinate of any I meet with, this having, in the whole Time, taken no less than six or seven Months, and the Cure not yet compleated ; although the smallest Part of the Neck is now not quite thirteen Inches, and the largest Part about fifteen and an Half.

What Swelling remains, is at one particular Part only, and has, now, more of the Appearance of what it is vulgarly term'd — a Wen in the Neck, but is much more soft, and more loose than it was at first, and appears to waste much faster, than at the former Operations.

34. Another Person troubled with the same Kind of Malady, but not of long Continuance, has

has lately began with the same Operations ; which Swelling abates much faster than the former.

Operation. Let the Person take hold of the End of the Connecting-chain or Wire of the Condensing-phial, and bring it to one Side of the Swelling, and lay one End of another Wire or small Rod to the other Side of it, then guide the other End to the excited Apparatus, and it is done.

N. B. The Person always feels the Effects at the Part where the Fire comes out of one metallic Body into the Neck, and out again, at the other Part of the Neck, into the other metallic Body, *viz.* the Part where the Fire passes through even the least Part of Air : Were it not for the violent Agitation it suffers by passing through the Air, there would, in all Probability, be no more Sensation at those two external Parts, than at the other tender and soft muscular Parts contain'd between those two Parts.

DIALOGUE IV.

B. AR E those Disorders abovemention'd all that you have taken any Notice of ?

A. Those are chiefly what I took so much Notice of as to write down ; a great Part of which were soon after I began these Experiments ; for, although I at first determin'd to write down all that seem'd of any Consequence, yet, through Hurry of other Business, it was neglected ; the greatest Part of which were rheumatic Complaints ; this Kind of Treatment of the Rheumatism seldom fails in relieving young Persons, particularly if took in Time ; and, though many have been cur'd when farther advanc'd in Years, yet sometimes it fails ; and, what was very remarkable, a Man upwards of seventy-three Years of Age, having been very much afflicted for many Years, was constantly reliev'd

H

by

by Electricity for the Present, and the Disorder as constantly return'd, and generally the same Day ; some others which receiv'd no Benefit, might perhaps, had it been longer continu'd ; or perhaps fail'd for Want of better Skill in applying it : But I am so far from admiring that it does not always succeed, that I have much greater Reason to admire at finding it succeed so often, particularly at first Setting out ; I having then no guiding Point to steer from, but public Papers, and those always silent, as to the Way and Manner of the Operation.

B. Many of those Cures, which you have been relating, must be own'd to be very extraordinary ; but, if they are not look'd on as impossible, yet will they be thought very improbable : For can it be suppos'd credible that any one Thing can have both a Power and Tendency to help in so many different Disorders, particularly as the most salutary Medicine in Nature has never been known to be endu'd with such wonderful Qualities ; and that all this Power should be found where there has by no Means appear'd sufficient Reason to expect it ? To say the Truth, the Supposition of such an absolute specifical Quality in Electricity is look'd on by the most judicious Part of Mankind as merely chimerical, and as groundless, as to expect the pretended great Feats to be perform'd in Agues, by Charms ; or the still greater, by *Bridget Bostic's* Fasting-spittle : But, supposing you had some Reason to believe that you had no Way impos'd on yourself, yet Conclusions are by no Means to be precipitately form'd and settled ; for those cannot safely be made, but on the most mature Deliberation.

A. All this must be own'd to appear reasonable, and I can't deny but I was much astonish'd and confounded myself, at seeing such mighty Things perform'd

perform'd by Electricity ; I mean, before I could see any rational Principle to found them on : But after having pursu'd those Experiments, and consider'd the Nature of electrical Æther very attentively ; its great Subtilty and Power, its active and enlivening Qualities, and its mighty Tendency to accelerate the Motion of the Fluids in general, and that of the Blood in particular ; and especially after having followed it so long as to discover it to be the very Æther, or most powerful subtil Medium, of Sir Isaac Newton, and other eminent Philosophers : Then, indeed, I began to think myself on firm Ground, and concluded that I had been so far from pursuing an *Ignis Fatuus* in the Bogs, that all those surprising Effects were, probably, nothing but the necessary Consequences of such a most powerful Agent, when thus determin'd and directed to human Defects ; I therefore apply'd myself with greater Assurance and much more Confidence than before ; and the Success which attended such electrical Experiments, more and more confirm'd me in my Opinion, that this was one great End it was ordain'd to serve, after it had been thus fully and plainly discover'd to us ; namely, that of helping in bodily Infirmities.

Having so much to found it on ; join'd with so many successful Experiments, and in so many different Cases, as must necessarily offer in the Space of six or seven Years, for I refus'd the Trial to none, so that, had I wrote down all the Cures, both great and small, that were this Way effected, they must have been sufficient of themselves to have fill'd a handsome Volume : It is therefore presum'd they will not, after so much Experience, be look'd on as immature and rash Conclusions, especially as the same Success, in many of the like Cases, seems to be invariable ; and to bid fair, particularly in Inflammations, and Swellings in gene-

ral, and even in extreme Coldness of the Feet, for a Specific *.

In some longer Time, when we have seen such Reasoning and Experiments still more confirm'd, we shall, in all Probability, be so far from thinking the whole electrical Phænomenon to be inexplicable, and the several Cures, perform'd by the Power of it, like so many Paradoxes ; that it is presum'd it will appear most rational to expect such, or like Effects ; particularly if the learned Gentlemen of the Faculty (whose peculiar Province it is to search into the Nature and Causes of such Maladies, and to apply a sovereign Remedy to each) had Leisure and Opportunity strictly to examine into its Nature, Properties, and Effects ; who might very probably soon be able, from a regular Process of well chosen Experiments, to form so regular a System of practical Rules, as to be capable of judging in what Cases it might prove a Specific, and in what Cases not, especially when they enter into their friendly Consultations ; for Want of which, I have admir'd, that, by being so injudiciously apply'd, it has not many Times been attended with real ill Consequences.

B. Wherein do you imagine the specific Quality of the electrical Virtue chiefly to consist ?

A. The Way and Manner in which it is observ'd to operate, when convey'd to the Fluids of the Body, is an admirable Tendency to promote a free Circulation, as is obvious by many of the above-mention'd Disorders, where a too languid Motion was visibly the Case.

Most, also, if not all Tumours, yield to this Kind of Treatment in a wonderful Manner ; for,

* I have not had the Trial in many remarkable Cases of the Cramp, but, likewise, in all those which I have experienc'd, it never once fail'd me.

to say the Truth, I scarcely ever met with one so hard or stubborn, but what it either broke or dispers'd, even though it were of the scrophulous Kind *: Other slighter and more recent Swellings are so soon and easily cur'd by Application of electrical Æther, as if not able to stand before it; as likewise Inflammations in as remarkable a Manner.

In a Word, not only the most common Disorders, which are caus'd by an Obstruction of the Motion of the Fluids in general, but even the Fluid of the Nerves in particular, whether it be the nervous Fluid of Anatomists, or this fluid Æther; for, where the most remarkable Numbness has happen'd, it has been almost instantaneously taken away by Means of Electricity, when timely apply'd; and when the like has happen'd, and been let alone some longer Time, I myself have made Use of it but twice, before it was cur'd: Palsies, also, when taken soon after their first Coming, often yield to this Kind of Treatment, of which there are not wanting a Number of Instances.

B. There was indeed great Expectation from Electricity in that very Disorder, but now it seems to be entirely at an End, since the Account in the *Gent. Mag.* for Nov. 1755, which informs us of two paralytic Cases, in the County Hospital, at Shrewsbury; in one of which it produced no visible Effect, and, in the other, it twice rendered a partial Palsy universal?

A. That Account, I have Reason, as well as you, to believe was no small Disappointment to many eminent Physicians, who were in great Hopes and Expectation of, one Day or other, see-

* If taken in Time, it seems to open the Obstructions, by dilating the Passages, and accelerating the Motion of the Fluids; but, when let alone a longer Time, it brings them to a more speedy Digestion than any other Means.

ing the salutary Effects of Electricity in that particular Disorder: Those two remarkable Cases you mention, appear'd just at a Time when I was trying the Effect of Electricity on a Person who had a Palsy in the Tongue, which had taken away the Use of it, as to render her so speechless, as not to be understood.

This Disorder seem'd to yield to the very first Operation, and, after a few more, she could speak many Words intelligibly, yet, notwithstanding it bid so fair for a speedy Cure, she neglected the Use of these Means all at once; but the before-mention'd Account in the *Magazine*, happening just at the same Time, so alarm'd, that I was not much at a Loss for the Reason of her not venturing any more Trials.

I had been accustom'd to hear electrical Treatment of bodily Disorders so banter'd, ridicul'd, and misrepresented, that I imagin'd there might probably be some unskilful Management, Misrepresentation or the like, in that Account, if not downright foul Play; I was therefore determined to see, if possible, the Original, in the *Philosophical Transactions*, from whence the Account was taken; and, to shew I was not mistaken, I beg Leave to recite the Whole.

Article 94th, Part 2. Vol. 48, of the Philosophical Transactions, printed in the Year 1754; Part of a Letter from Dr. Hart to Mr. William Watson, F. R. S. giving some Accounts of the Effects of Electricity, in the County Hospital, at Shrewsbury.

SIR,

Salop, Nov. 5, 1754.

"WE have try'd the Effect of Electricity in
"many different Cases, though I can't
"say we have had much Success in its Use, ex-
cept

"cept in the Case of one Woman, whose left Arm had been paralytic some Years, so as to be ever absolutely motionless, and senseless of Heat, Cold, or Pain, and remain'd so, notwithstanding all the Endeavours us'd to remedy it.

This Person had her Arm electriss'd frequently, and the Sparks drawn from it, and the greatest Blows given to it, for many Days successively, whereby, in about eight or nine Days Time, her Arm grew sensible of Pain and Warmth, &c. and she had some little Motion of her Fingers, being able to grasp any Thing with her Arm down, or before her; but she could not lift it up to her Head any better. This encourag'd us to continue the Electrissing it three Weeks or a Month longer; in which Time she had got some little Strength in her Arm, could open and shut her Fingers, and lift it half Way to her Head: But the Pain she had from the Electrissing, and the Fear that increas'd continually of new Shocks, made her obstinately resist using it any longer; and she chose, she said, rather to remain *Paralytic*, than undergo such Operations any more; for which Reason, she was discharg'd out of the Infirmary, with such little Relief as above-mention'd, and I never have heard more of her: I wish, indeed, she had try'd it a While longer, as it bid so fair to do her Service: This was the only Case which gave us any reasonable Hopes from its Use."

Here it is presum'd I may fairly stop, before I mention the other Case, so long at least, as to appeal to the candid Reader, whether the Publisher of that Account, as it stands in the *Magazine*, has shew'd himself an impartial Writer; or not rather some groveling Mortal, who imagin'd he had some private Interest that would be risqu'd, if bodily Defects could be reliev'd by Means of Electricity;

otherwise he could never have endeavour'd to stifle the Knowledge of so extraordinary a Case, by telling the World *no visible Effect was produc'd.*

Quære, Whether such a Misrepresentation does not allow sufficient Room to suspect, that all which we find transcrib'd from the *Philosophical Transactions*, on that Page and the next, (of the *Magazine*) was for the Sake of those few Lines, in order to degrade Electricity ; and that what we find relating to other Things, before and after, were only design'd as a Blind, or Skreen, to hide his Intention ; otherwise, as above, what could be meant by publishing so great a Falshood, as that it produc'd no Effect, when there appear'd the greatest Probability of a Cure, in an otherwise incurable Disorder, and which had continu'd not only motionless, but so dead, as to be insensible of Heat, Cold, or other Pain, for Years before ?

Such Snakes in the Grass have been no small Hindrance to the Progress of electrical Treatment of human Disorders, who are glad of taking all Opportunities to ridicule and expose it, or else endeavour to make it appear terrible, as in the above *Magazine*, to deter others from attempting Trials of that Kind ; and, in order the more effectually to expose it, confidently deny, that any real Cure was ever effected by such Means, and that, to their own certain Knowledge, never any Benefit was found at particular Hospitals, tho', they assured them, the Method had been often attempted ; and then, with a grave Countenance, appeal to their own Understanding, whether they could think, that, by only Rubbing of Glass, Amber, or the like, any such mighty Feats as were pretended to, were possible to be perform'd ; and thus they plausibly deceive those who are not expected to know better.

Were

Were there really no Design, the best Excuse that can be made for those mighty Pretenders to Reason, is, that they are as ignorant of the Nature and Properties of this ætherial Spirit, as those they are reasoning with ; but, notwithstanding this, it is presum'd, they can't endure to be thought thus ignorant.

These Things brought to my Mind what a certain Person, skill'd in Surgery, had observ'd to the young Lady, *Cafe the 13th*, when he saw the Cure in its Progress, taking such ample Steps, and, perhaps, as he might imagine, almost compleated, (altho' it happen'd otherwise, on Account of the Relapse, by her dropping the Use of Electricity all at once) *viz.* he desir'd her to remember, that he had told her before, *Time* only must effect the Cure : But, surely, he had great Reason to believe, that neither *Time* only, or *Chance* only, was the Cause.

I must own, when I have been relating this Account, I could not forbear being so pleasant, as to remark, how exceeding favourable *Time* was to the young Lady's Disorder, while the Cure was attempted, by Means of Electricity, and how unfavourable when under any other Method of Cure.

B. Do you imagine the Editor of the *Magazine* would be guilty of such a Misrepresentation of a Matter of Fact ?

A. I am not willing, by any Means, to think him the Person, because I see no End he could have in doing it ; and it may reasonably be suppos'd, when any Thing is transcrib'd from the *Philosophical Transactions*, and sent him, he expects something very curious, and therefore inserts it, without farther Examination.

The other *Cafe*, mention'd by Dr. *Hart*, was as follows :

" A young

“ A young Girl, about sixteen, whose right Arm was paralytic, on being electris’d the second Time, became universally paralytic, and remain’d so about a Fortnight, when the increas’d Palsy was remov’d, indeed, by the Medicines which her Cafe indicated ; but the diseas’d Arm remain’d as before : I should have mention’d too, that this Arm was greatly wasted in Comparison of the other.

“ However, notwithstanding the former bad Accident, I had a Mind to try the Effect of Electricity on her again, which we renew’d ; and, after about three or four Days Use, she became, the second Time, universally paralytic, and even lost her Voice and Tongue, and with Difficulty could swallow : This confirm’d me in my Opinion, that the electrical Shocks had occasion’d these Symptoms. We therefore omitted it, and the Girl, tho’ she grew better of her additional Palsy, for so I call it, remain’d as bad as before of her first.”

It must be own’d, here does not appear the same Misrepresentation ; yet, what serves his Purpose better ; for here appears a Fact, exactly, as it were, adapted to his Liking, and very fit to cast a Slur on what he was aiming at ; but then here plainly appears something like Want of sufficient Skill in the Operator ; and the chief Reason for my searching into the original Account, was, because I imagin’d the Shocks given must be exceeding great, otherwise they could never have caus’d a universal Palsy ; nothing being more likely to produce a Palsy, than the strongest Blows that may be given by Means of Electricity, particularly, if the prepar’d Phial be enlarg’d to the Size of Mr. Rackstraw’s ; for then the whole nervous System might possibly be so shock’d, as to take away the Use of the Limbs of the strongest Man living, and,

by the Power of two such Glasses, perhaps, to strike him dead in an Instant : And, altho' we will not suppose any such large Glass was made Use of in the above-mention'd Case, yet, the united Force of several smaller ones might, as effectually, take away the Use of the Limbs of the latter Person, who was, perhaps, at best, but weakly.

The Consideration of these Things ought, at least, to caution against shocking the whole Body, when only an Arm, &c. is affected ; and, that the diseas'd Arm only may receive the Shock, let that Part only of the Body be made a Part of the Circuit, as above directed, form'd for that Purpose, and then other Parts will be sure to receive no Harm, were the Blows given ever so hard ; and, in the promising Success of the Person before-mention'd, who had a Palsy in her Tongue *, the Operation was perform'd after the same Manner, *viz.*

The Chain from the Condensing-phial was brought to the Origin of the Nerves, at the hinder Part of the Neck ; then, a Wire being laid to her Tongue, the Shock was afterwards produc'd, by bringing the other End of it to the hooked Leading-wire, or else to the Gun-barrel on which it was suspended.

N. B. At such Times as the Experiments are found to succeed best of all, and if there may be any Danger of having Shocks too great, in any particular Case, then it may not be amiss to make Use of a four Ounce instead of an eight Ounce Condensing-phial.

B. Why should you think the Doctor's Indiscretion was the Cause of the bad Effects mention'd in the latter Case ?

* Page 102.

A. You mistake me; I don't, by any Means, think the Doctor to blame, who appears to have acted no otherwise than any ingenious and candid Enquirer, that had nothing more at Heart than the Health of his Patient; he relating the Whole in an impartial Manner, and expressing himself in a compassionate Way, and with no small Concern at the Foolishness of the first of the two Patients, in so obstinately refusing to go thro' with what promis'd so fair for a Cure: But the electrical Operator did not seem to understand the Nature and Properties of it, at least in the Cure of bodily Disorders, otherwise he'd never have imagin'd, that the greatest Shocks were the most effectual, in that or any other Disorder, because, if he understood it, he must necessarily have known, that they might be given so strong, as greatly to injure the Body; and

Moderate Shocks are, for most Complaints, found to be of greatest Service; those which I make Use of in common, being what are describ'd by many, rather as an Uneasiness than real Pain; and, in between six and seven Years Practice, I scarce ever met with any, who receiv'd Benefit by it, but were afterwards fond of, it; then what Blows must be given to a Person to cause her so obstinately to refuse what had given such a hopeful Prospect of the Recovery of no less than a lost Arm? But her Reason the Doctor gives in these Words:

" The Pain she had from the Electrizing, and
 " the Fear that increas'd continually of new *
 " Shocks, made her obstinately resist using it any
 " longer;" And it must seem something remarkable, that such powerful Shocks should ever do

* Probably, new-invented Shocks, so as to have them stronger than ordinary.

her so much Service as they did ; which, had she been of a weak Constitution, might possibly have render'd her as universally paralytic as the other.

As the Case of the Palsy in the Tongue, before-mention'd, afforded me not a fair Trial, I beg Leave, in this Place, to take Notice of a remarkable Case of the like Kind :

Edinburgh, April 18. A remarkable Instance of the Power of the electrical Aura has lately happen'd in this Place. *Robert Moubray*, who, in the Beginning of *January*, was struck with a compleat Palsy of the Tongue, and, since that Time, entirely lost the Use of his Speech ; was taken into the *Royal Infirmary* some Weeks thereafter, where, by the Use of Remedies, he was, in a great Measure, reliev'd of other Symptoms that attended him ; but, the Palsy of his Tongue remaining obstinate, he was at last order'd, by the Physicians, to lay aside the Use of all Medicines, that he might fairly try what Electrifying would do in such a Case : Accordingly, last Week it was begun, and by *Saturday* he was able to extend and put out his Tongue, which, till then, had remain'd dead and motionless : On *Monday* he could plainly articulate a few Words ; and, after repeating the Experiment on *Tuesday*, he spoke distinctly, to his own great Joy, and the Surprise of all who were present. *Gentlemen's Magazine for April 1751*, Page 152.

B. Although you seem so positive, that if Gentlemen of the Faculty were to busy themselves in searching out the Virtues of this electrical Æther, and to apply it to Disorders of the human Body, they would soon acquire such a Knowledge of it, as to be able to perform great Things ; yet have we not been sufficiently inform'd to the contrary, by the *Gentleman's Magazine for July 1755* ? Are not there various Disorders mention'd to have been treated

treated by this Method, at the famous Hospital at *Upsal* in *Sweden*, by a Physician? Which Method of Treatment was continu'd for a considerable Time; and when he comes to his Conclusion, and sums up the whole, it appears to be very inconsiderable, nay, even sometimes it has actually done real Harm; and this Account, we are assur'd by the Publisher, is of indubitable Authority.

A. That Account may possibly be very well attested, for which Reason, and some others, it may not be improper to enquire into the Particulars; I would first therefore take Notice of those Disorders, in which he allows it to have been of real Service; and then consider of those, wherein it has appear'd to be of little Effect, either the one Way, or the other; and, lastly, of those in which it was found to be really prejudicial.

Of bodily Diseases and Maladies, in which Electricity has been found serviceable at Upsal in Sweden, by Dr. ZETZELL. Gent. Mag. for July 1755.

Of Contractions.

" **E**lectricity has certainly remov'd so many Complaints of this Kind, as to deserve being tried wherever the like occur.

1. " One who had lost the Use of his Limbs, from Cold, for several Years, was, at length, quite restor'd by the Use of Electricity.

2. " Another, whose Knee-joint had been above five Years contracted from a Rheumatism, was able to straighten it after twice Electrifying.

" But, in attempting the Cure of such Disorders by this Method, it is of great Importance to distinguish carefully which are the Muscles that are affected; for it is those alone from which

" Sparks

“ Sparks are to be drawn, and by no Means
“ from their Antagonists, which, on the other
“ Hand, should be relax’d by warm Fomenta-
“ tions, applied for some Hours together, and af-
“ terwards anointed with some emollient Unguents.
“ At the Beginning of this Course, the Stomach
“ ought to be fortified with some generous Li-
“ quor, lest the Matter remov’d from the Joint
“ should be deposited upon the nobler Parts *.
“ The electrical Shock is not near so efficacious,
“ as simply Drawing out the Sparks †.

In Deafness and Singing of the Ears.

3. “ When Deafness arises from indurated Wax,
“ the Drawing off Sparks by an iron Stile will help
“ to dissolve it, or, if the Deafness has follow’d a
“ Fever, it will promote the Digestion of the Me-
“ taftasis ; but in a catarrhal Deafness, arising ori-
“ ginally from a humid Air, and in Singing of
“ the Ears, all that could be done by Electricity,
“ turn’d to a very little Account.

In the Epilepsy.

4. “ In some Epileptics, it has certainly been
“ serviceable ; but if the Complaint was heredi-
“ tary, or owing to a Fright, it did no sensible
“ Good or Harm.

In Felons.

5. “ The electrical Sparks bring them to a
“ speedy Digestion.

* This Caution might very well have been spar’d.

† This is just according to the Situation of the Disorder ; if
superficial, then Drawing off Sparks is observ’d to be the best
Way ; but, if more deep, then Shocks are found to be most
effectual.

In Ganglions.

6. "In the only three Cases of a Ganglion, on which Electricity was tried, it dispers'd them perfectly.

In the Tooth-ach.

7. "Where the Anguish was owing to hollow Teeth, or from a catarrhal or scorbutic Habit, it seldom fail'd of producing a perfect Cure, though at first the Pain seem'd to be increas'd, and rag'd for twenty-four * Hours, after which it went off entirely. The Sparks should be drawn from the affected Tooth, by Means of an iron Stile, † for a good while together.

In Palsies.

8. "The Commotion with the *Leyden* Phial has been made with Paralytics here, without any Benefit; nor were the Muscles irritated, by drawing Sparks from them, with any better Consequence; yet sometimes, by Chance, the Pain has been so severe on an otherwise insensible Part, as to be hardly tolerable; and, when such Parts were once discover'd, the Sparks were continually drawn from them alone: This was repeated so often on a Citizen of *Upsal*, who was a true Paralytic, that he was perfectly cur'd thereby."

Of inveterate Head-achs.

9. Of confirm'd and inveterate Head-achs I never had much Experience; but, even in those, he

* Many are almost instantly cur'd, and I scarce ever remember any one that complain'd of its Raging for a Minute afterwards.

† A few small Shocks, perform'd as at Page 131, are found to be much better.

takes Notice, that, where proper Internals were given at the same Time, the desir'd Effect was speedily produc'd.

In very bad Fits of the Head-ach, I have often made Use of Electricity, with surprising Success ; and the first Experiment I ever attempted, relating to Disorders, was on one who had a continu'd raging Fit for a Fortnight, which was presently cur'd.

N. B. In all the above-mention'd nine Disorders, the Doctor allows Electricity to have been of Service, either more or less. But,

In the two following, he could not find it of any Benefit, nor does he charge it with doing any Harm.

Hysterical Disorders.

1. "In these it was never found to be attended "with the least Benefit."

Amaurosis, or Gutta serena.

2. "In two Patients, the electrical Sparks were "drawn from the Parts near the Eyes, without "the least Benefit ; nor was the electrical Shock, "from the Phial, found to succeed better ; so that "Electricity promises little in this Disorder."

He likewise mentions two other Disorders, in which it had but little Effect ; but in those I never had any Opportunity for Trials, namely, Costiveness and Agues.

In the three following he thinks it to be very prejudicial.

In the Sciatica.

1. "In some, the Pains have been greatly ap-peas'd by Electrification, but return'd again afterwards ; in some it was not at all abated ; in others the Success appear'd extraordinary at first,

I

"but

“ but after a few Days the Disorder was turn'd up
“ on the Intestines, with excruciating Torments.

In Rheumatisms.

2. “ What has been said before, about the Sciat-
“ tica, may be affirm'd of this Disorder.

In the Gout.

3. “ Pains of the Joints were frequently ob-
“ serv'd to cease, by exciting the electrical Sparks ;
“ but then the gouty Matter seem'd to be repell'd
“ inward, and produc'd Symptoms of more griev-
“ ous Consequence : So that it was often found,
“ that, if this Application was continu'd, Pains of
“ the Head, Vertigo's, Sickness at Stomach, and
“ violent Gripings would take Place, which again
“ disappear'd, as soon as Nature was able to repel
“ the morbid Matter back to the Joints. Some,
“ under this Treatment, urin'd very plentifully,
“ and fell into copious Sweats in the Night, which
“ gave Hopes, that in Time the Obstinate of the
“ Disease might be thus subdu'd ; but Experience
“ prov'd the contrary, the before-mention'd ill
“ Symptoms all returning in a severer Degree ;
“ so that all Hopes of Benefit to gouty Patients,
“ from Electricity, are at an End.”

GENERAL REMARKS.

I. On *Hysterical Complaints.*

IN those, tho' the Doctor never knew it of any Service, yet have we no small Hopes, not only from Cases 19th and 20th, but from other Trials already made (together with the Properties observ'd in this enlivening and vivifying Spirit) it is expected, that there are few Distempers, in which it will be found much more effectual ; for as the

most remarkable Property of the electrical Æther, in these Kind of Operations, is observ'd to be in raising the Spirits, by accelerating the Motion of the Blood, and other Fluids of the Body; so no Distemper can require it more *.

But, in this inactive Disorder, it is not to be done by Halves; not for a few Minutes only, which is sufficient in some others, particularly if it has taken deep Root; but the Person to be electris'd ought to stand or sit on original Electrics for an Hour in the Morning, and another in the Evening, each Day: If two Hours each Day can't be comply'd with, let it be two Half-hours; this may be first practis'd, with sometimes simply Drawing off Sparks; afterwards with some light Shocks, and, then if the Disorder require it, to be increas'd with more: Such Proceedings I seldom found to fail of desir'd Effects.

N. B. The salutary Effects of simply Electrifying appear to be produc'd by Respiration only; for a Person, being electris'd on the Resin-cake, is so envelop'd in the electrical Æther, as necessarily to breathe much more of it than at other Times, and which as necessarily appears to accelerate the Motion of the Blood in general, prov'd by Mr. *Rackstraw's Experiment*, p. 67.

* Some have objected, that to raise the Spirits by any artificial Means is of very little Service, any otherwise than for the present; and a Person is, many Times, observ'd to be the worse for it afterwards: It is true, indeed, when they are raised by any Kind of spirituous Liquor, this is generally the Case; but when raised by this active Agent, that is, by accelerating the Motion of the Blood by Respiration, the Effects are much more permanent, and rather like the chearful Satisfaction, which we experience after the Hearing of good News. This Method of raising the Spirits will, in all Probability, be found much to exceed the only successful Method besides, which, perhaps, can be prescrib'd in that inactive Disorder, namely, bodily Exercise.

II. On the Amaurosis, or Gutta serena.

As to Distempers of the Eyes, I was never bold enough to engage with them, except in Inflammations, or the like, in which it generally succeeds; and, indeed, Inflammations of every Kind it is observ'd to disperse in a very remarkable Manner, most probably by dilating the capillary Passages, as well as separating and dividing the clogg'd Particles of the stagnating Fluids, and removing the Obstruction, by accelerating the Motion of the Blood.

This Operation is best perform'd by setting them on the Resin, and drawing off the Sparks.

In Answer to what is said concerning the Gutta serena above-mention'd, viz. that he could never observe the least Benefit to accrue to the two unhappy Patients labouring under it; I must beg Leave to relate a particular Case of that Sort which happen'd at Home, and which appears to be of as unquestionable Authority as those from Sweden.

Extract of a Letter from Mr. FLOYER, Surgeon at Dorchester, to Dr. BENT, a Physician at Exeter.

I HAVE lately had two or three Opportunities of trying the Effects of Electricity on paralytic Persons with Success: What most of all tends to prove its good Effect on the human Body, is the following Case:

A Boy, of about seven Years old, was taken blind suddenly in both his Eyes, without any previous Fever, Pains of the Head, or any other Indisposition of Body, which one might reasonably imagine to be the Cause of his Blindness. About 3 or 4 Days after he had lost his Sight, he was brought

brought to me for my Advice. Upon inspecting his Eyes, I found the Pupil of each so entirely dilated, that I could not discover of what Colour the Iris was, not the least Verge of it to be seen, but the Cornea, transparent, appear'd one continu'd black Spot. I ask'd his Father, if he ever took Notice what Colour his Eyes were, before he lost his Sight : He told me they were of a remarkable light-grey Colour. Upon shutting his Eye-lids, and rubbing them a considerable While, and then exposing them suddenly to the Sun-beams, I could not perceive the least Degree of Contraction in the circular Fibres of the Iris, and the Pupils remaining the same, whether the Eyes were open or shut, or whether in the Dark or Light ; neither could he perceive any Difference when an opaque Body was interpos'd between his Eyes and the Light of the Sun, and when there was not : In short, he was as blind as if he had had his Eyes cut out. I told his Parents, it was my Opinion he would never see again as long as he liv'd, for there was seldom or never a Cure for such Disorders of the Eyes, taking the Case to be a perfect Gutta serena in both Eyes, occasion'd, as is generally imagin'd, by some Obstructions in the Optic Nerve, and consequently paralytic ; I determin'd with myself to try the Effect of the electrical Shock upon the Lad, especially as I had met with Success in some Cases before. Accordingly, I order'd him to be brought to me next Morning, when fastening an iron Wire, coming from the Condensing-phial fill'd with the Filings of Iron, to his Leg, and another round his Head, which Wire, after the Phial was satiated with the electrical Matter, I brought near the Conductor, and produc'd a surprising Snap, which struck him backward, and made him cry out terribly, so that it was with the greatest Difficulty we could persuade him to

repeat the same ; but we at last prevail'd, and gave him three Shocks more. That Day he was put to Bed, and continu'd there till the next Morning, sweating profusely all the Time ; but agreeably alarm'd his Father in the Morning, by crying out, he could see the Window. When he was brought to me the second Time, I could perceive a small circular Rim, of a light-grey Colour, round the Outside of the Iris, and observ'd that he knew when I put my Hand between his Eyes and the Light of the Sun : This gave me great Encouragement to repeat what we had done the Day before. The next Day almost half the Iris could be seen, with some small Degree of Contraction and Dilatation : The third Day he could discover and distinguish Objects : The fourth Day he could distinguish Colours, with a brisk Contraction and Dilatation of the Iris : The fifth Day, after repeating the Experiment, I observ'd the Iris to contract and dilate as well as ever ; and, upon a strict Examination, found the Boy's Sight perfectly restor'd, the Colour of the Iris the same as before he lost his Sight, and the Eyes, in every Respect, as well as if no Disorder had happen'd to them.

*Dorchester,
May 23, 1751.*

ANTHONY FLOYER.

To Dr. BENT, in Exeter.

WHEN I sent you the Case of the blind Boy, I forgot to mention one Circumstance, which was the Application of a Blister Plaister to the Nape of his Neck, the Day before he was first electris'd. As the Parents of the Boy importun'd me very much to do something for him, this was the first Thing I thought on ; but, after I had determin'd with myself to try the Effects

fects of the electrical Shock, I never once thought of the Blister, till a Day or two after the electrical Experiments, when the Mother of the Boy desir'd to know what should be done to the Blister, for it was almost dried up. I told her she should take no farther Care about it, that it did not signify any Thing, and that I had forgot I had order'd it. Whether this Blister had any Share in recovering the Boy's Sight, or not, I will not take upon me to say ; but I would not omit any one Circumstance, which, if not mention'd, might perhaps, after it was known, occasion a Suspicion of an Imposition.

I have got the Case attested by those only who saw the Boy at first, and saw him electris'd every one of the Days ; had the Satisfaction to see his Sight return gradually ; and were Eye-witnesses to every Circumstance.

The Father has been examin'd by Hundreds to the Truth of it. The Boy is frequently sent for by Gentlemen of the Country, when they come to Town, to examine him. In short, every Body in this Part of the Country is satisfied of the Truth of it.

Since I wrote you my last, I have cur'd two Girls of Obstructions, by the electrical Shock, one of whom took Medicines a Twelvemonth to no Purpose.

Yours, &c.

Dorchester,
Dec. 12.

ANTHONY FLOYER.

We whose Names are hereunto subscrib'd, do certify, that one *William Clark*, a Boy of about seven Years old, of the Parish of *Fordington*, near *Dorchester*, was taken blind suddenly, and continu'd so five Days, by his Father's Account. We saw him examin'd by Mr. *Anthony Floyer*, Surgeon ;

and by his Account, and by the Observations we ourselves made, we thought him Stone-blind. He was electrify'd, five Days successively, by Mr. *Floyer*, and the sixth Day, on a strict Examination, we were convinc'd he could see as well as ever he did in his Life, and his Sight still continues perfect.

Jeremiah Clark, Father of the Boy.

Thomas Meech, M. D.

Dorchester,

Dec. 11, 1751,

Hubert Floyer, Surgeon.

John Swabridge, Apothecary.

Edward Stephens, Gent.

Arthur Mitchell, Gent *.

Remarks on the Gout.

WHAT he says of the Gout, is like what he has said of the Sciatica, namely, that of repelling the morbific Matter inwardly, though with still greater aggravating Symptoms.—And he concludes ;—so that all Hopes of Benefit to gouty Persons from Electricity are at an End.

Answer. This is very discouraging to those afflicted with Visitations from that dreadful Guest ; I mean those who experience it in the worst Manner ; for, as to those who are troubled with it in a less Degree, I am well assur'd it will yield to electrical Treatment, from the Trials I have made ; though they have been not so numerous as those made in many other Disorders ; the Reason, in some Degree, will appear farther on.

The World, in general, behold the surprising electrical Experiments with Astonishment, and are confounded at the amazing Phænomenon, yet are unable to form any Conception either of its Nature or Production.

* *Supplement to Gent. Mag. for 1751, p. 578.*

But as this subtil ætherial Medium which was only conjectur'd by all former Philosophers, is now fully discover'd to us ; so we have an Opportunity put into our Hands of examining and enquiring into its Nature and Properties, by making almost what Number of Experiments with it we please.

And, notwithstanding those Philosophers had no other Method of discovering such a subtil Medium but by its Effects, yet so necessary and universal an Agent could not but appear remarkably plain, in those Effects ; accordingly they are observ'd to describe it as exactly, as if they had been furnish'd with the present electrical Apparatus, to arrest, detain, and torture it with Experiments, in Order to render it visible, and to discover wherein its great Strength and Energy lay ; who accordingly inform us of its extreme Subtily, Velocity, elastic or expansive Power, as well as attracting and repelling Forces ; all which Properties exactly agree with electrical Æther ; and we find the sagacious Sir *Isaac Newton* goes so far as to pronounce it the mechanical Cause of animal Motion, as if firmly persuaded, no nervous Fluid, or any created Substance, was endu'd with Power and Activity, sufficient to perform so great an Office, but his subtil Fluid only.

If then muscular Motion, that otherwise unaccountable Work of Nature, is perform'd by the active Power of this subtil Agent, we have no Reason to admire at finding in it a Power of accelerating the Motion of the Blood in an Animal, nor of dilating the Passages, which appear to be the principal Manner in which this healing Power operates ; I say we have no Reason to admire that it should accelerate the Motion of the Blood, when a more than ordinary Quantity is convey'd to the Body in general, if we only consider the above-mention'd Experiment, which accelerates the Motion

tion of the whole Mass of Blood, p. 67; and many of the Maladies before-mentioned plainly prove it to perform the like Office at particular Parts; or, at least, what appears much like it, by dilating the Passages, and, at the same Time, separating and dividing the clogg'd Particles, as before hinted; for otherwise we could not so constantly behold many Obstructions so soon remov'd.

But as the greatest Part of Mankind are ignorant of the Existence of any such necessary Agent, as Æther is allow'd to be; so they can form no Manner of Idea, how it is possible that this strange Fire should have either a Tendency or Power to heal, but are much rather inclin'd to believe such Accounts to be trump'd up, or invented by artful and designing Men to delude the Heedless; these seem to be the chief Reasons why the Treating of bodily Disorders, in this Method, has not been more attended to, after so many well attested Accounts of its Usefulness.

Another great Reason why it has been so disregarded, is the great Pains which are taken by some others to expose and ridicule this Method of Treatment, and, at best, allow no more to it than to a common Quack-medicine, though there may be sufficient Reason to believe it one of the greatest of temporal Blessings ever yet discover'd to us, and perhaps the greatest that human Nature is capable of; for, what is all the Riches and Honour in the World, or, indeed, what is Life itself, without Health to enjoy it?

Were it not for the above and such-like Reasons, even the Cases 21st, 22d, and 26th would, in the Gout, in other Methods of Cure, be thought sufficient Encouragement, at least, to attempt the Trial.

I have had no more Trials of the Gout, but on those who were slightly attack'd, and who receiv'd Benefit

Benefit so suddenly, that they could scarce think it the Effect of Electricity.

But there have not been wanting many Instances both from abroad and at home, where Electricity has been practis'd with great Success on this Disorder; and I am firmly persuaded, that the inveterate and most chronical Disorders of this Kind, even though hereditary, will, in Time, be found to give Way, if not quite conquer'd by this Method of Treatment: But, in making such Attempts, great Caution ought to be observ'd, and by no Means attempted in the Violence of a Fit, but rather when it is entirely gone off; because it is so much easier to prevent than to cure Diseases: And, where it appears the most formidable, there to use the greatest Caution, and to begin with simply Electrifying; that is, only to stand or sit on the electrical Cake for Half an Hour, or an Hour, once or twice a Day; and, in some Time after, begin to draw Sparks, *viz.* cause the Fire to burst at the Part or Parts affected; but no Shocks, excepting some few weak ones, for Fear of rousing the Lion; and, whenever attempted, to observe the aforesaid Caution, *i. e.* that the Wire or Chain coming from the Condensing-phial be not brought to the diseas'd Part, but a different Wire or iron Rod; and then to bring the other End of it to the excited Apparatus; by this Means, there will be no Danger of pushing the morbid Matter inwardly, because, then, the Motion of the subtil Fire is conceiv'd to be the contrary Way.

When any of those Shocks are given, the Connecting-wire may sometimes be held in one Hand, sometimes the other, and sometimes under the Foot; or, if the Coating of the Phial be touch'd with a Finger, still the Shock will be produc'd, and the Fire pass the right Way *: If it be requir'd to pass

* Outwardly from the disorder'd Part.

through

through any particular Part, as of a Limb or Joint; let the Connecting-wire be brought to one Side of the Limb or Joint through which it is to pass, and put one End of an iron Rod or Wire to the opposite Part; because it moves through in a direct Line, from one metallic Body to the other, whenever the contrary End of the Rod is brought to the excited Gun-barrel, or any other Part of the excited Apparatus. But to return from this Digrassion,

In the foremention'd Account from *Sweden*, although the Doctor has taken Notice of so many Cases wherein Electricity has been of real Service; yet, when he comes to what he calls his Conclusion, he seems willing to set it quite aside, by concluding it like to prove of very little, if any, real Advantage to Mankind; I may therefore justly appeal to the candid Reader, whether or not he has shew'd himself an impartial Writer.

Surely! what nothing to be expected from that which he has found capable of performing such great Things, and in so many different Disorders! *viz.*

One having lost the Use of his Limbs, for several Years, to be quite restor'd by the Use of Electricity.

Another, whose Knee-joint had been contracted for above five Years, from a Rheumatism, was able to straighten it after twice Electrifying.

Ganglions, he says, all the Cases in which it was try'd, it dispers'd them perfectly.

A truly Paralytic, and Citizen of *Upsal*, was perfectly cur'd thereby.

In various Cases of the Tooth-ach, it seldom fail'd of a perfect Cure.

In some Epileptics too, he says it has certainly been serviceable.

Deafness also in some Cases;

And

And are all these promising Hints, if there were no more, like to prove of no real Service to Mankind? Are we to expect nothing from this partial Account, nor from all the more impartial Accounts, so frequently communicated from other Parts?

Does it not seem as if all he had said, relating to its Usefulness, was only what he was oblig'd to, by public Authority, rather than Inclination? Otherwise we should never find him, in his Conclusion, so plainly endeavour to unsay all again; not once mentioning any real Good he thought it capable of, but does not forget to repeat what he had said before, concerning its being prejudicial; and, even while he is relating any good Quality, he can't forbear ushering it in, rather as the Contrary; particularly at his fifth Observation, where he says:

In all Cases, a long Use of Electricity *brings on* a Costiveness, and an Increase of Appetite, most probably from promoting insensible Perspiration: But this, if ever so true, must be so far from proving it prejudicial, that perhaps nothing can speak much more in its Favour; at least, a common Medicine, endu'd with such specific Qualities, would be not a little set by; even that of generally bringing on a Costiveness; were it only for its Usefulness as an Antidote in opposite Disorders.

Quære. Whether the most Healthy are most inclin'd to be costive or laxative? Because the Costiveness he there speaks of, may very probably be what only naturally arises from a more confirm'd State of Health, rather than any hurtful Quality in the Specific.

From the surprising Effects I have observ'd in Electricity, I have no Room to doubt, but that, if a Person were, before he made Use of Electricity, too

too costive, from some natural Disorder; but that a long Use of it would even prove, in some Measure, an Antidote to that very Disorder, which he says a long Use of it always brings on: And this, not from promoting insensible Perspiration only, as he imagines, but chiefly from promoting a due Circulation, and the salutary Effects arising from it, as well perhaps sensible as insensible Perspiration. And,

In a Word, the Cause of all the bodily Organs performing their proper Functions, and by that Means rendering the Body healthy; and I am not able to mention one Disease in which I think it would be prejudicial, excepting that of a Fever, where the Blood has already acquir'd a too great Celerity, and Electricity is not like to retard it; and, though I can't expect it to cure a Fever, yet I really believe a long Use of it would prevent one. But,

Surely, an Increase of Appetite is no bad Symptom, but rather a Confirmation of the above-mention'd salutary Effects, and that the digestive Faculty is improv'd.

How far this Account, from *Sweden*, concerning Electricity, apply'd to Diseases of the human Body, will agree with the Account from *Sweden*, mention'd in the *Gentleman's Magazine*, for March 1755, will appear by relating it.

A succinct Account of Disorders lately cur'd at Stockholm by Electrification.

TH E Tooth-ach, if proceeding from a Detrusion of Rheum, is presently affwag'd, or totally remov'd, by this Remedy.

A Gentleman of Distinction, who had been almost deaf a considerable Time with a Singing in the Ears, was cur'd in three or four Minutes.

A Man,

A Man, 57 Years old, deaf for 32 Years past, from a Wound under the left Eye, and much afflicted with a violent Tooth-ach, was cur'd of this Complaint immediately, and, soon after, his Hearing, in a great Measure.

A young Man, of 22, who had almost lost his Hearing for six Months, by violent Vomitings, which forc'd Blood out at his Ears, was cur'd in as little Time as the former, and continues to hear perfectly well.

A Girl of seven, born deaf, who consequently could not speak, began to hear Words spoken very loud in her Ear, and could repeat some of them in a few Days.

In the Year 1744, a young Fellow of 19 fell into a Well, and continu'd there above Half an Hour for Want of Help; since which Time his Hearing has been very weak; he has found much Benefit from being electrify'd, and, it is hop'd, will be perfectly cur'd.

A Stone-cutter, whose Knees and Joints of his Toes had been render'd stiff, and Fingers crooked, was able to go to Work after a few Days Electrification. It has been found to recover, or greatly abate, all rheumatic Pains of the Muscles.

A Lad, who had a severe Sciatica in the right Hip, from a Fall from a Scaffold, so as not to bear being touch'd, was cur'd in a few Days, so as to be able to walk without a Staff.

Another, who had us'd Crutches for seven Years, could walk without them in 13 Days, and burnt them for Joy.

A Girl of 13, who had been lame, after the Small-pox, from four Years old, now walks without a Staff, having been electrify'd no more than 20 Times.

N. B. All these Persons were electrify'd under the Direction and in the Presence of the King's Phyli-

Physicians, who attended by his Majesty's Orders.

In this Account from *Sweden* appears something like undisguis'd Truth : Here we find no subtle Remarks and Conclusions, in order to unsay all again ; here are no palpable Contradictions, no excruciating Torments, nor Bugbears, to deter the World, if possible, from making Experiments of this Kind ; nor does it appear likely to produce any such tremendous Effects, for, if so, we should, long before this Time, have been thoroughly convinc'd of it, among such a Number of Practitioners on human Disorders, particularly at their first setting out ; but, on the contrary, the good Effects were so obvious, and the salutary Hints exhibited were so many and plain, as rather to shew a necessary Tendency to heal, for otherwise no natural Reason can be assign'd for the applying it so early in the Morning, after its great Improvement, to those Disorders ; and the many wonderful Cures, perform'd in this Way, strengthen and confirm the same.

These, and such-like Considerations, are more than sufficient to tempt us even to believe, that in all this the *immediate* Hand of God was present, particularly in the first Discovery to Professor M. *de Muschenbroek* ; for that was the first Time it was ever known, or so much as suspected to be endu'd with any great Power or Force ; and scarcely any other Method could have inform'd him, than the Experiment he was then making : An Experiment so uncommon, and what must otherwise have appear'd so uselefs, that no one can imagine for what Reason he attempted it.

B. But, as you charge the Author of the latter Account from *Sweden*, viz. that of *July*, with downright Contradictions, it will be expected you should prove them ?

A. They are so obvious, as to require no other
Proof

Proof than what is to be found in his own Account, particularly at his Conclusion. Thus Observation 2d:

" In rheumatic, arthritic, and sciatic Complaints, it is very seldom that any Advantage is gain'd, but rather the reverse, from a Translation of the morbific Matter inwards."

If the contrary was not well known, such an Assertion from one who had had so much Experience, would have been sufficient to deter most others that heard of it from ever attempting a farther Trial. But let us hear what he says himself, when speaking of Contractions of the Joints : " Another, whose Knee-joint had been above five Years contracted from a *Rheumatism*, was able to straighten it after twice Electrifying. —— Quæry, What could have a much greater Appearance of a Miracle !

" One who had lost the Use of his Limbs for several Years, from a Cold, was, at length, quite restor'd, by the Use of Electricity." Quæry, Are not Colds of this Sort allow'd, by most, to be of the *rheumatic Kind* ?

Again, Observation 3d, " There is a great Agreement between paralytic and rheumatic Disorders :" And yet he says, a Citizen of *Upsal*, who was a true Paralytic, was perfectly cur'd thereby.

Are not here Contradictions from his own Account ? But, if more Proofs are necessary, take the following from his own Country.

In the above Account from *Sweden* of March 1755 :

" It has been found to recover, or greatly abate, all rheumatic Pains of the Muscles, and even in the Sciatica.

" A Lad, who was so severely afflicted with it in the right Hip, from a Fall from a Scaffold, as not to bear being touch'd, was cur'd in a few

" Days, so as to be able to walk without a Staff." Altho' this is the very Disorder, which the latter Author, for July 1755, affirms was turn'd upon the Intestines, with excruciating Torments; and who afterwards informs us, that what had been said of the Sciatica, might be affirm'd of the Rheumatism likewise: But, if farther Proofs are still requisite, I might only appeal to all who have made Trials of this Kind, particularly in the Rheumatism: All seem thoroughly convinc'd of the salutary Effects of Electricity in this Disorder; and great Numbers of the Cures, which the Public have been so often presented with, have been rheumatic Complaints.

And, altho' in my Catalogue there are not many of that particular Disorder, yet, perhaps, Persons afflicted, and found Relief from Electricity, were five to one of any other particular Disorder; not that I have so much Reason to believe it more effectual in relieving those Complaints, than many others; but only, that more Persons afflicted with the Rheumatism apply'd for Relief.

But, to say the Truth, the Author should seem to mistake the Nature and Properties of this subtile Medium, in advising what he calls simply Electrifying, by Drawing off Sparks with his iron Style, otherwise it should seem natural to imagine, that such a Disorder as the Sciatica must lie too deep to be much affected with a Method so superficial; but, when the electrical Æther is convey'd by the Method of Shocking, the deepest and most internal Parts are as easily pervaded as the most superficial.

But, altho' Drawing off Sparks with an iron Style, or a Finger, is not sufficient for this and many other Complaints, yet, in a great Variety of those which are more superficial, it is observ'd to be the only Method, and will be found exceedingly useful; as in most Kind of Swellings, not too deep, also Inflammations, Tetterers, Ring-

worms, Shingles, St. Anthony's Fire, Knots in the Flesh, &c. and *Cæse the 11th*, altho' so remarkable, yet was no otherwise treated.

In Cramps also it is of Use, tho' more effectually cur'd by moderate Shocks : In cold Feet it seems to bid fair as a Specific, by conveying to them a Number of Shocks.

Either of these Methods are found useful in the Tooth-ach, but small Shocks in this also will be found most effectual ; being sometimes instantly cur'd, at other Times not. The Method of performing the Operation is thus :

If it be an under Tooth, bring the End of the Connecting-wire under the Chin and Tooth, and lay the End of another Wire to the Top of the Tooth ; then bring the other End of it to the excited Apparatus, and the Circuit will not only be compleated, but the electrical Æther will pass the right Way : If an upper Tooth, bring the End of the Connecting-wire to the Top of the Fore-head, as near as may be over the Tooth ; then lay one End of the iron Style to the Bottom of the Tooth, and, at bringing the other End to the excited Apparatus on which the Phial is suspended, the Æther, as before, will pass thro' the Tooth.

Note, When any one performs this Experiment, or any other with the Phial, if they desire the Shock to be small, they must be sure to touch it quick, for, the quicker it is touch'd, always the weaker the Shock ; so that nothing is more easy than to lessen or enlarge the Shocks.

That mercenary Views may not be thought the chief Motive of my saying so much in Favour of Electricity, I should advise one of these Machines to be kept in most Families that have Conveniency, Opportunity, and Leisure to make Experiments of this Kind ; for, I am well satisfy'd, they would find their Account in it, so as to answer the small Trouble and Expence : And, from the

Hints here given, any one might easily and soon become Master of Knowledge sufficient to make a proper Use of it; for, if I were not thoroughly convinc'd of the Usefulness of it, I should have been very far from giving myself so much Trouble concerning it.

B. But, as you seem to be giving away the Art and Knowledge, which you have taken so much Pains to acquire, you will be far from being thought wise; and if there is, really, any Thing in what you have been so strenuously pleading for, and if bodily Disorders may be so easily cur'd, without the Help of Medicine, yet, you will not be thought good; because, then, what must Thousands do, many of which, having no other Way of maintaining themselves and Families, than by dealing in Medicine only? Therefore, by endeavouring to propagate what you seem to think such a general Good, you may, in Reality, be doing much Harm and Injury to your Neighbour; besides, as you are so nearly related to ——, you don't appear to act the Part even of a prudent Parent.

A. But we must take Care not to lose Sight of the grand establish'd Maxim; which Maxim is according to the Law of God, of Nature, and of political Government; namely, that any private Emolument, or Advantage, must always give Way to that of the Public.

To apply this Maxim.

IF any Person was thoroughly persuaded in his own Mind, that what has been said concerning an universal healing Quality, in this electrical Fire, were true, and he should think he had an Art beyond others, so as to make it generally useful; and, on the other Hand, he had some small private Interest to risque in publishing it:

The

The Question is, if it could really be question'd, whether that small private Good ought to be put in Competition with so grand a public Good? And the Answer is obvious.

As to your grand Reason, that of sacrificing a Part of the worldly Interest of one of the nearest of Relations; this is the only effectual Means I have to shew you, that I am sincere, and in good earnest.

And, as I am so thoroughly convinc'd of its inestimable Value, so no worldly Advantage ought to be of any Weight, at least so as to hinder me from endeavouring all in my Power to propagate the Knowledge I have acquir'd in that Way.

How common a Thing is it to hear many extolling such a meritorious Act, as *a Man's Dying for, or in the Defence of his Country*, but more especially when it is to redeem it from *actual Slavery*? This, by many, is thought so meritorious an Act, that it is a common Thing to hear even the Dastard vaunt, that he should think it one Degree of Happiness to die in *so great a Cause*; which, if so, then what a most puny Hero? Hero, did I say! rather, what a most groveling Wretch must any one be, who would not, for the *common Good of all Mankind*, so much as risque the least Part of his temporal Interest!

CONCLUSION.

FROM the foregoing Consideration of the Nature of reflected Motion, by Means of so complete Elasticity in the Æther, or electrical Fluid aforesay'd, particularly when one of those non-electrical Circuits is compleated, in order to convey the Shock *; it is reasonable to con-

* As at p. 44, 45.

clude, that, notwithstanding the pure Æther contain'd in the Body of the Animals, Metal, Water, &c. that compos'd it, be in Contact throughout the Circuit; yet the visible Fire produc'd in the Phial is not suppos'd to move throughout, but only the contain'd Æther push'd forward, by Means of the elastic Force of the Fluid.

To illustrate which, and to explain my Meaning,

I beg Leave once more to suppose, that a large Army of Men, on a large Plain, had form'd themselves into a Circle by joining Hands, and the Shock convey'd to them all by Means of one of those electrical Operations; there surely could be no more Reason for imagining the visible electrical Fire, produc'd in the Phial, to be carry'd all round the Circle, and not rather stop before an entire Revolution be made; any more than there would be to conceive, that, if a solid Wheel of the same Circumference, (with its Axis perpendicular to the Horizon, could be made to turn quite easy and free on its Axis) must necessarily make a whole Revolution before the Power, and consequently the Motion, was at an End; but must rather, long before a Revolution was compleated, necessarily make an entire Stop, notwithstanding the most violent projectile Motion that could possibly be communicated to it.

What seems to confirm this, is, Mr. Watson's Observation on large Circuits, who informs us, that the Fire and Explosions at the Machine, *viz.* at the utmost Extremity of the Connecting-line, were very small in Appearance, notwithstanding the Shocks were as sensibly felt by those who form'd those large Circuits, as by those that form'd the lesser ones.

On the contrary, when a Piece of Wire, or iron Rod, is only brought from the Coating of the Phial to the Leading-wire, or else to the prime Conductor

Conductor on which it is generally suspended ; the actual visible Fire, *viz.* the Visibility generated in the Phial, seems then continu'd quite thro' it in a Torrent, and an exceeding bright Ball of fierce Fire bursts forth at the End of it.

Those two Experiments concerning the largest and smallest Circuits, when compar'd and consider'd, seem plainly to confirm what has been said of the Course steer'd, or the Way the electrical Æther moves from its State of Confinement in the Phial ; and not only indicates, that such Motion is from the Body of the Phial and leaden Case, along the Connecting-line, as at p. 44, by observing so small an Appearance of Fire at the other End of it, in the large Circuits, and the great Quantity exhibited thro' the short Circuit, or Connecting-wire ; but also, that the momentary Motion is propagated, or reflected, as suppos'd at p. 27 ; and thus the greatest and least Circuits are, in Appearance, perform'd in the same Space of Time —— So that it seems most natural to conclude, that, by Means of that violent Percussion in the Phial, a Circuit is no otherwise perform'd than this, *i. e.* however great the Stroke or Impulse at the Phial may be, the same Violence is reflected throughout the whole Circuit, altho' the actual Fire, which, when the Room is darken'd, we always behold in the Phial, is by no Means continu'd throughout, but all that appears to be perform'd as a Circulation, is the removing each Part of the Circuit or Column of Æther, contain'd in those Pores of the dense Non-electrics which form'd the Circuit, more forward every Time a Shock is given, or Percussion in the Phial is repeated, than it was the Time before.

That it makes not an entire Revolution, at every Explosion or Flash in the Phial, that is, every Time a Shock is repeated, is what may also be reasonably suppos'd, by observing that the smallest

and greatest Shocks are equally propagated to any Distance, and, though sometimes so small as not much to exceed even a strong Pulsation of an Artery, yet will it be as instantaneously reflected throughout a large Circuit, as when they are ever so strong.

These are such Reasons as induce one to believe, that when a Circuit is form'd, in order to convey the electrical Æther, by Way of Shocking, to any Malady in the human Body, particularly, such as *Case the 14th*, where the Fire was guided quite through the whole Body; it may not be the safest Way to trust to one or two Shocks only, for that may, perhaps, be only removing the stagnant Æther from one Part of the Body to another, which Method, in all Probability, cannot be so eligible, nor the Æther so salutary and enlivening, as if moderate Shocks were oftener repeated, and the active Spirit, or electrical Æther, were sure to move not only through the Part affected, but also that, by this Means, such stagnant Æther may be displac'd and driven quite out of the Body by the new; and thus this Manner of Treatment of bodily Disorders appears to be most rational; the Want of the Knowledge of which has been none of the least Reasons why such a Method of Treatment has not made a greater Progress, but instead thereof been much banter'd, ridicul'd, and set at nought. And,

As there are many Things in Nature, which we find to have a Power to fix this Principle; so there is sufficient Reason to believe it is often, in some particular Constitutions, detain'd, and so fix'd, as to hinder and impede a free Circulation in general, and at other Times, in particular Parts, so fix'd, as to be the Cause of the very worst of Disorders, such as Cancers, scrophulous Tumors, and the like, which appear so very stubborn as to yield to no Medicine ever yet discover'd.

If such Disorders, when the Obstruction first began, were to be treated by this Method ; from what has been already observ'd, there don't appear to be any Doubt of an absolute Cure.

And although, when other Means have been formerly us'd for accelerating the Blood in some dangerous Cases of Obstructions, such as Mortifications, &c. they have prov'd so far from relieving, that they have very much heighten'd and increas'd the Disorder ; yet this was never found to be the Case, even in that particular Disorder ; when the Motion of the Fluids has been accelerated by Electrification ; for which Reason, it may be naturally suppos'd, that the electrical Æther not only accelerates the Motion of the Fluids, but also dilates and opens the Passages, as well as separates and divides the clogg'd * Particles of the Blood, and other Juices, that so the Circulation may be again carried on.

And, as there are few general Rules without their Exceptions, so no Doubt but this may be, sometimes, found true here also in some Degree, and it may very possibly appear from the Effects, that the Acceleration of the Fluids may be, sometimes, too quick for the Dilatation and Opening of the more solid Parts, and in such Cases it may be suspected to cause Pain for the present † : And this might very probably be the Reason, that the Gentleman mention'd, *Case the 12th*, complain'd of more Pain, though it was attended with no other bad Symptom ; yet this, however, ought to teach us to proceed with the more Caution in violent Pains, particularly those of the Head in general, and of the Ears or Eyes in particular, as being some of the most tender Parts ; for thus

* As at Page 122.

† In Burns this seems to be the Case, by much increasing the Pain.

proceeding, in a more cautious and light Manner, may not only be the safest Way, but the most effectual in many Cases, though something longer in performing.

B. But you are not sure, that the Operation is perform'd this Way?

A. I am as sure, as Reason and Experiment can make me, and therefore it is presum'd it must rest here, till a more plausible Reason, supported with equal Experiments, can be produc'd to shew the contrary.

Disorders in general, that lie near the Surface of the Body, such as Inflammations and Swellings of most Kinds, are effectually cur'd by only setting them on the Resin, and simply Drawing off Sparks from the affected Part; and not only so, but often-times Swellings that extend to some Depth: I have also found it to have very salutary Effects, even when a Person has only stood on the Floor, and brought a disorder'd Part, as a Hand, Finger, &c. to the excited Gun-barrel, or other Part of the Apparatus; and this is so easily accomplish'd, that a Person is, many Times, able to perform an Operation on himself, without any Assistance.

This last Method I have often practis'd with good Success, and never found any ill Consequences attend it: The Reason why I don't practise it more constantly is, because, by this Method, the Direction of the electrical Matter is, from the excited Gun-barrel or Wires, inwardly, thro' the Malady, &c. and from thence, thro' the Body, into the Earth.

The Danger, if there were any, of such Power or Force repelling or pushing the morbid Matter inwardly *, must be entirely avoided by the other Method of Drawing Sparks from the Mala-

dy, while the Person is electris'd on the Resin; because then the Course and Direction of the electrical Æther is thro' the Patient's Hand, which communicates with the excited Apparatus while on the Resin, and from that Hand the nearest Way thro' the Malady, outwardly, and from thence thro' the Wire that draws off the Sparks, and thro' the Operator into the Earth, by *Experiment the 2d.* But

I have elsewhere shewn, that there does not appear the least Probability of any such tremendous Effects from Electricity as are pretended to, particularly with an iron Style, nor while we confine ourselves to such small Condensing-phials; and have also shewn, in a Variety of Cases, that the Way and Manner in which the electric Virtue appears to operate, is in a powerful Tendency to promote a free Circulation of the Fluids of the Body in general; yet, when the active Agent is convey'd to the Malady, then it appears to be determin'd to that Part only; and I can't help repeating it again, that, were not the solid Passages dilated, as well as the clogg'd Fluids dissolv'd † by this subtil Principle, no probable Reason can be assign'd for those salutary Effects so speedily produc'd in so many different, and, otherwise, obstinate Cases.

And altho' Disorders that are more conceal'd, and lie farther from the Surface of the Body, as Rheumatism, Sciatica, Pains of the Bones and Joints, &c. are more effectually cur'd by sending the electrical Æther thro' the Parts by Means of Shocking them; yet, Pains of the small Joints, as of the Fingers, &c. are many Times cur'd, by only simply Drawing off the Sparks at those Parts while electris'd on the Resin.

† Pages 116, 122.

N. B. Having, while in *London*, the Pleasure of seeing the ingenious Mr. *Watson*, I was giving my Opinion concerning the Way and Manner in which this active Principle operates, when we behold such salutary Effects, by applying it to the Cure of bodily Disorders; and told him I had great Reason to believe it to be perform'd by accelerating the Motion of the Fluids of the Body; and what the more confirm'd my Conjectures was, its great Propensity of accelerating the Motion, in general, of Fluids already in Motion.

He told me it was question'd whether the electrical Fire really accelerated the Motion of the Fluids or not; and that, if the Experiment of the capillary Syphon were accurately made both Ways, the Water, discharg'd in a given Time, would perhaps be found equal; that is, whether it were electriss'd and flow'd in a Stream, or whether it were not electriss'd, and mov'd off gently in large Drops, yet the Quantity might be equal: This being what I had never tried, I could say but little to it.

But since, reflecting on those two Experiments, I consider'd, that supposing Mr. *Watson's* Conjectures were granted, and the Quantity of Water evacuated by the Syphon in a given Space of Time was equal in both Cases; yet the Greatness of the Activity of the Water which appears at the End of the Syphon, when the Water is electriss'd, beyond what is to be seen before, must be abundantly sufficient to inform us, that the real Motion of the Water is thereby greatly accelerated: Whether a greater Quantity of Water be actually discharg'd in the same Time, seems not very material, but whether the Motion be really increas'd; that is, whether the Motion be not greater when it moves violently off at the End of the Tube in Streams and flying Particles, than when it has no other Power of moving from it than that of its own Gravity; insinuating, as it were, almost insensibly from the End of the Tube. Hence,

Quæry. Whether the beholding the same Quantity of Water so very much separated into active little Streams, and flying Particles, from the End of the Syphon, may not reasonably be suppos'd to favour my former Conjecture ; namely, that, by conveying the electrical Fire to a human Malady, the clogg'd Particles of the Fluids are thereby separated, by which Means they become fitted to pass those Canals which before they were thus separated, they were incapable of doing.

P O S T S C R I P T.

TO shew I am not mistaken, when I affirm, *Experiment the 2d*, that the Æther is passing thro' the Apparatus of Wires and Person into the Earth, all the Time he touches it with a Finger while standing on the Floor, altho' at the greatest Distance from the Machine in Motion, and altho' no Sense informs him of it:

Let one End of a Piece of Wire be well coated with Sealing-wax, and, if a Person hold it by the coated Part, no sooner is the other End of the Wire laid on the excited Apparatus, but the Thumb and Fingers are sensible of it ; and, if held but lightly, the Eye also, for it will dart violently thro' the Sealing-wax to the non-electric Fingers all the Time ; so great is its Propensity of returning into the Earth.

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F I N I S.

E R R A T A.

At Page 38, Line 28, instead of p. 34 and p. 58, read p. 19
and p. 37; and at Page 39, Line 25, instead of p. 18, read p. 29.

John Morgan
Grenville Gluthor ^{the} 10. Jan^r
Sir ISAAC NEWTON's 1753

Æ T H E R REALIZED:

Or, The SECOND PART of the
SUBTIL MEDIUM PROVED,

A N D

ELECTRICITY rendered Useful.

B E I N G

A Vindication of that ESSAY, in Answer to
the ANIMADVERSIONS made thereon by
the MONTHLY REVIEW;

W H E R E B Y

The ELECTERAL FLUID, and the SUBTIL ÆTHERIAL FLUID of Philosophers are, from the NEWTONIAN Principles, clearly demonstrated to be one and the same Thing :

W I T H A

Variety of REMARKABLE OBSERVATIONS relative thereto.

By R. LOVETT,
Of the Cathedral Church of WORCESTER.

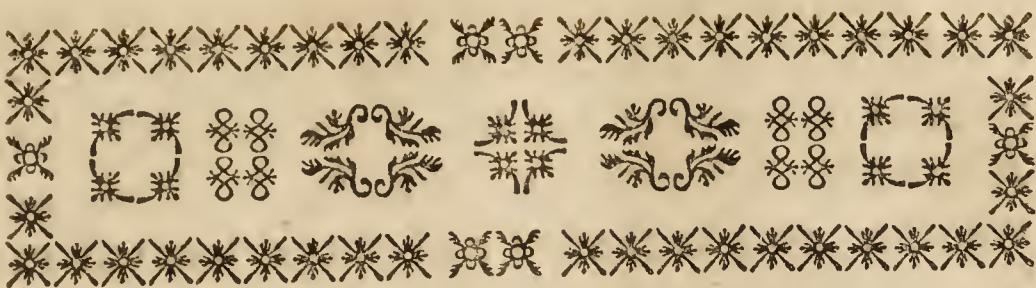
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1759



Sir ISAAC NEWTON's
Æ T H E R
REALIZED, &c.

T may perhaps be thought some-
thing particular, that, as a Reply to
the *Monthly Review* was intended,
why it did not appear till two Years
after : To which I answer ; I had for a con-
siderable Time after the Publication of that
Review, given over all Thoughts of making
any Reply to it ; but being in Company with
a Gentleman of my Acquaintance, he thought
proper to tell me, my Book on Electricity
was (to use his own Expression) knock'd
o'the Head by the *Monthly Review*. This
harsh Reflection caused me to tell him, I was
very sure the Authors of that Review knew
but very little of Electricity, for otherwise
they would never have condemned me ; and
that

that Part of my Pamphlet relating to the Production of Electricity, for not being explained according to the Principles of the *Newtonian Philosophy*, which, as I might well say, was because I had not performed an Impossibility, and that I was able to prove as much from Sir *Isaac Newton's* own Words, and that the Laws by which such a subtle Spirit acted were not then known, for Want of proper Experiments; so that after Reasoning with the Gentleman some little Time, he told me, if what I said could be proved, I was to blame if I did not return an Answer to that Review, or to the same Effect.— This was what determined me to make a Reply to their Charge; but what protracted the Time to so great a Length, was almost continual Interruptions.

However, on the whole I had reason to believe, that the length of Time before I made my Reply, answered one useful Purpose; which was, that some Things worthy of Observation lately occurred to my Thoughts, which I had not considered before; and having, after the Publication of that Review, no Hopes of a second Edition of the Pamphlet, whereby to communicate to the Publick any Amendments, or farther Improvements, since my first Impression, or rather my Ability of writing on the Subject of Electricity was condemned; for though with so little Reason (as will appear farther on) yet I
soon

soon found a visible Alteration in the Sale of the Pamphlet; so that I may truly say, my second Attempt on Electricity was the ill Success of my first, on Account of the Animadversions made thereon by that Review.

The particular Places of my electrical Essay, with the Animadversions on the same, are as follow.

Monthly Review for Dec. 1756, p. 561.

Title Page.

" The subtle Medium proved, or that wonderful Power of Nature, so long ago conjectured by the most ancient and remarkable Philosophers, which they called sometimes Æther, but oftner Elementary Fire, verified. Shewing; that all the distinguishing and essential Qualities ascribed to Æther, by them and the most eminent modern Philosophers, are to be found in electrical Fire, and that too in the utmost Degree of Perfection: Giving an Account, not only of the Progress and several Gradations of Electricity, from those ancient Times to the present, but also accounting, First, For the natural Difference of electrical and non-electrical Bodies. Secondly, Shewing the Source or main Spring from whence the electric Matter proceeds. Thirdly, Its various Uses in the animal Oeconomy, particularly when applied to M- ladies and Disorders incident to the human Body,

“ Body, illustrated by a Variety of known
 “ Facts. Fourthly, The Method of applying
 “ it in each particular Case. And, Lastly,
 “ The several Objections brought against it ac-
 “ counted for and answered.”

ANIMADVERSIONS OF THE REVIEW.

“ The Author has saved us the Trouble of
 “ telling the Reader, what he may expect to
 “ meet with in this Pamphlet; the above Ti-
 “ tle being a compendious Epitome of the
 “ whole Performance.—It will also be suffi-
 “ cient to apprise him, that, whatever Dis-
 “ coveries may be contained in it, are not de-
 “ livered in a very elegant Manner. Our
 “ Author has, in his Preface, made an Apo-
 “ logy for this, and candidly owns he has
 “ been unhappily deprived of those acquired
 “ Abilities, of polite Education, &c. and
 “ adds that, therefore, whatever can be
 “ plainly and clearly made appear by one
 “ in such a Situation, will be allowed to be
 “ the Effect of undisguised Truth only, as
 “ depending principally on Facts.”

REMARK.

Then comes their infallible Reason to prove that all I have said relating to the Production, &c. of the electrical Fluid stands for nothing.

ANIMADVERSIONS.

"But the Want of literary Accomplishments,
" is not his only Defect ; for though he seems to
" have delivered his Sentiments with Candour
" and Sincerity, yet, at the same Time it ap-
" pears, that he is a Stranger to several of the
" common Principles of the Newtonian Philo-
" sophy, and consequently but indifferently qua-
" lified to account for the many surprising
" Phænomena of Electricity."

REMARK.

I must own I was so far from being disappointed at this, that it was the very Thing I expected from some Zealot or other for the *Newtonian Philosophy* ; I mean, if my Pamphlet was thought worthy of Notice.— But is this arguing like candid Philosophers ? Is what appears so much like a Sophism (pardon the Expression) supported by no real Proof, to pass for sound Reasoning ?

N. B. This I call a Sophism, not because they endeavoured to make the World believe, that the Production of Electricity was not to be accounted for, without the Assistance of a previous Knowledge of the *Newtonian Philosophy*, when they were not sure of it, but chiefly because of such an Insinuation.— Namely, That I pretended to account for the whole electrical Phænomenon, or, as they term it, *the many surprising Phænomena of Electricity*,

not-

notwithstanding they at the same Time allow my Title Page to be a just Epitome of the whole Performance; and if so, I may as justly appeal to themselves, whether I have been guilty of such an enormous Presumption or not; and I do assure those Gentlemen, I am so far from thinking myself capable of accounting for the *many surprising Phænomena of Electricity*, that I am rather inclined to believe, Electricity has opened the largest Field for Enquiry, that was ever known, even so great as probably never to be exhausted.

That I expected some such kind of narrow Treatment, appears from what is hinted in the Preface of that Essay.

I had no Doubt but there were those so bigotted to the *Newtonian Principles*, that would think I had been too free, and had not stuck close enough to them; but if Electricians* are to be shackled and tied down to any kind of known Principles whatsoever, they'll move on but heavily towards a clearer Discovery of the many surprising Phænomena of Electricity.

And now let me ask, what has been more prejudicial to true Philosophy, or what has more retarded its Progress than Faction, when joined with Prejudice and Bigotry? Is it not generally allowed, that Bigotry in Philosophy

* A Term made use of in Mr. Franklin's Letters.

sophy has been as pernicious in its Effects with regard to Truth as Bigotry in Religion ; and notwithstanding this, yet how readily we fall into the same Error, which we so justly condemn in others.

What could be more absurd and ridiculous, than the establishing *Aristotle's Philosophy* in the Schools, in such a Manner that no other must be admitted ; where it is to no Purpose, even at this Day, to urge that Sir *Isaac Newton's Philosophy* so greatly excels, as that the other ought to yield to it.

It is in vain, it seems, to press the strongest Reasons, since *Ipse Dixit*, pronounced with a magisterial Air, and imperious Voice, decides all Controversies.

And don't we act the same Part over again, just as if we thought Philosophy had received its utmost Stretch of Improvement, when we admit of nothing which is not explained according to the *Newtonian Principles*, but condemn it before we have considered whether it is capable of being explained by these Principles or not, as in the present Case.

Thus we observe, an *Ipse Dixit* to be the dernier Resort of the *Newtonians*, as well as the *Peripatetics* ; and is the *Ne plus ultra*, as well without as within the Schools.

Mr. *Cotes*, in his Preface to the *Principia*, after confuting some of the Tenets of *Des Cartes*, and others, argues thus :

“ All sound and true Philosophy is founded
“ on the Appearances of Things, which if
“ they draw us never so much against our
“ Will, those Principles are not therefore to
“ be laid aside, because some Men may per-
“ haps dislike them. They may call them,
“ if they please, Miracles or occult Quali-
“ ties, but Names maliciously given, ought
“ not to be a Disadvantage to the Things
“ themselves: Philosophy must not be cor-
“ rupted in Complaisance to these Men, for
“ the Order of Things will not be chang’d.”
[And if all true Philosophy is founded on Ob-
servations and the Appearance of Things : I
hope I may without Offence communicate
to the World such Observations as I have
made on these modern Experiments, parti-
cularly such as I had never seen taken Notice
of by others.]

“ Fair and equal Judges will therefore give
“ Sentence in Favour of this most excellent
“ Method of Philosophy, which is founded
“ on Experiments and Observations. To
“ this Method it is hardly to be said or ima-
“ gined, what Light, what Splendor, hath
“ accrued from this admirable Work of our
“ illustrious Author,* whose happy and sub-
“ lime Genius, resolving the most difficult
“ Problems, and reaching to Discoveries, of
“ which the Mind of Man was thought in-
capable.

* Sir Isaac Newton.

" capable before, is deservedly admired by
" all those who are somewhat more than su-
" perficially versed in these Matters.—The
" Gates are now set open ; and by his Means
" we may freely enter into the Knowledge of
" the hidden Secrets and Wonders of natural
" Things. He has so clearly laid open and
" set before our Eyes the most beautiful
" Frame of the System of the World, that
" if King *Alphonsus* were now alive, he
" would not complain for want of the Graces
" either of Simplicity or of Harmony in it."

And may we not with as great Reason truly affirm, with regard to such a subtile, active Fluid as Sir *Isaac Newton* affirmed to lie concealed in the Pores of all gross Bodies, that now by Means of the modern Electricity, the Gates are set wide open.

In his Days such an Æther appear'd but very imperfectly, since it was no otherwise discernible than by a few casual Effects ; yet so manifest were those Effects that he spent no small Part of his Thoughts on it, endeavouring, if possible, to find out some Means or other to demonstrate the Certainty of the Doctrine : This must be allowed the Case, since we find interspersed in so many of his Writings something concerning the Subject.

But the Veil which then so obscured the Subject, is by Means of Electricity removed, or rather quite taken away ; and that there is in Fact such a subtile and powerful Agent

concealed in the Pores of gross Bodies, appears now in large indelible Characters, and so plainly, that he who runs may read them.

What an amazing Discovery this, and yet how neglected! Had we but another Sir Isaac Newton, to cultivate so great a Discovery, might we not say with the Author, *What Light, what Splendor*, should we not reasonably expect to be reflected from hence on the still hidden Secrets of Nature?

Had those Gentlemen Enquirers acted candidly, they would, at the same Time, when they had affirmed, that the Knowledge of the Newtonian Principles was absolutely necessary before the electrical Phænomenon could possibly be explained, have given full Proof of it, or at least, so far as to shew wherein I had failed for Want of the Assistance of those Principles; nor could any Thing less than such a Method of Proceeding, justify such an Insinuation.

That such Kind of periodical Criticisms are exceeding necessary, on Account of their Usefulness in pointing out such Subjects and Performances as appear most worthy of Perusal, is so obvious as not to be denied; yet on the other Hand it will also be allowed, that the Authors of such Reviews ought to be endued, not only with the greatest natural Abilities, but Men of the most extensive Learning, free from all Partiality and Attachment to Party on any Consideration whatsoever;

foever ; for otherwise they must frequently frustrate the laudable Work they have undertaken, in imposing on the Public, by misleading those who expect their Assistance.

'Tis true, these are such Requisites as are rarely to be met with in the same Person, and very few MARTINS are to be found ; but although this Inconveniency may be remedied by a Society of Gentlemen, well skilled in all the different Parts of Learning, and by that Means nothing might be censured but what is first carefully examined ; yet this does not appear to be the present Case ; and although I should be sorry to make any Reply that should seem to have the least Tincture of ill Nature, yet, in Vindication of my Performance in particular, and in Justice to the Cause of Electricity in general, I cannot help being so plain as to say, those Gentlemen appear, in great Measure, Strangers to Electricity ; for otherwise they must have been sensible, that after having made a sufficient Number of those Experiments with due Attention, it was very possible to acquire so much Knowledge of its natural Properties, as to be able to measure and compare it with the Æther as described by Sir *Isaac Newton*, and by that Means to discern whether they are one and the same, or two distinct subtle Fluids ; and this, without such a previous Knowledge of the *Newtonian Philosophy*. Had they been skilled in Electricity, surely they would have given a small Specimen of it,

it, by descending, at least, to some few Particulars, rather than such general Terms, and condemning all by the Lump.

Since Sir *Isaac Newton* supposes a certain subtle, active, and powerful Matter, constantly residing in the Pores of gross Bodies, and as the modern Electricity so undeniably proves the Truth of it, I thought I might boldly affirm they were one and the same subtle Fluid, especially as the electrical Fluid is endued with all the remarkable Qualities he ascribed to his subtle Æther : If this was what offended those Gentlemen, I here faithfully promise to retract all I have said concerning it, and make the most humble Submission, if they, or any one else, can prove the Existence of such another subtle Fluid in Nature, endued like this, with all the essential Properties ascribed to Æther ; but if no other such Fluid is to be found, 'tis presumed I have a Right to insist, that my Conclusions concerning their Sameness are just ; for thus far I am well assured Sir *Isaac Newton's* Principles will support me.

But they little thought that when this was proved I might have gone much greater Lengths, and on a firm Foundation, *viz.* I might have insisted, that this subtle Fluid operates rather as a Spirit than like gross Matter ; and that the Particles of Bodies do not mutually attract each other from any inherent Qualities in the Particles themselves, as is generally supposed, or in any other Manner than :

as

as they are acted upon by the Force and Action of this subtile Spirit: Though, had I proceeded so far as to affirm, that this subtile, active Spirit, was the Cause even of muscular Motion itself, Sir Isaac Newton would have borne me out, who thus concludes his inimitable *Principia*.

“ And now we might add something concerning a certain most subtile Spirit, which pervades and lies hid in all gross Bodies; by the Force and Action of which Spirit, the Particles of Bodies mutually attract one another at near Distances, and co-here if contiguous; and electric Bodies operate to greater Distances, as well repelling as attracting the neighbouring Corpuscles; and Light is emitted, reflected, refracted, inflected, and heats Bodies; and all Sensation is excited; and the Members of animal Bodies move at the Command of the Will, namely, by the Vibrations of this Spirit, mutually propagated along the solid Filaments of the Nerves, from the outward Organs of Sense to the Brain, and from the Brain into the Muscles. But these are Things that cannot be explained in few Words, nor are we furnished with that Sufficiency of Experiments, which is required to an accurate Determination and Demonstration of the Laws, by which this electric and elastic Spirit operates.” *Princip. Lib. III. p. 393. Motte’s Translation.*

Is it not well worthy of Remark, that Sir *Isaac Newton* has no sooner concluded his Demonstrations of the Laws of Bodies, but he tells us of another Kind of fine subtle active Matter in Nature, so different from the Matter with which those Bodies he had been treating of were composed, as if he imagined it belonged to another Class of Beings.

This active Agent appears to him, as the Life or Soul of common Matter, *viz.*, “*By the Force and Action of this subtle Spirit, the Particles of Bodies mutually attract each other.*” And does he not here plainly declare, that the Laws of Motion which he had been taking such indefatigable Pains to explain, and to which all common Matter was subject, were by no Means the same Laws by which the electric and elastic Spirit was governed.

May we not then from hence safely infer, that the *Newtonian Principles* are so far from being absolutely necessary to assist when this electric Spirit is to be explained, that they seem rather incapable of it ; as Sir *Isaac Newton* himself tacitly owns, when he tells us, “*they were not then furnished with such a Sufficiency of Experiments as was necessary to determine and demonstrate the Laws by which it operates :*” Nor indeed, were he still living to see such an electric and elastic subtle Fluid, actually produced from the Pores of gross Bodies, would it be possible for

for him to determine and demonstrate the Laws by which it operates, were he to be tied down to any known Principles whatever relating to grosser Matter.

And to say the Truth, we now seem thoroughly convinced, that to furnish out such a Sufficiency of Experiments was no other Way to be effected, than by Means of Electricity, which was what Philosophers were not then aware of, notwithstanding Electricity was in no small Perfection in Mr. Hawkesbee's Time, and after him brought to much greater Perfection by others, and at Length inflammable Liquids were kindled by it; yet, as in all this Time no considerable Force was observed in it, 'twas hardly possible to think it so powerful an Agent as it afterwards proved; consequently none imagined it to be the subtle and powerful Æther of Philosophers.

But after the *Leyden* Experiment was discovered, i. e. after a Method was *revealed* to *Van Musschenbroek* (pardon the Expression) to collect, arrest, and detain a *Quantity* of it; and particularly after that Method was improved with large Glass Jars, whereby a much greater *Quantity* was detained than in the *Leyden* Vial, which first discovered the Force: After the above Improvements, I say, the Force appeared to be so great as scarcely to be equalled by any Thing, and out-done by nothing; so that when compared with the Æther, as described by Sir *Isaac Newton*, it

was observed to tally with it to the greatest Exactness, even in its most essential Properties; such as extreme Rarity, Subtilty and Velocity, remarkable Activity, and surprising Elasticity; consequently, according to Sir Isaac Newton's own Rule, it must necessarily be what I had attempted to prove, namely, the very Æther itself; for, according to his first Rule of Reasoning in Philosophy,

“We are to admit no more Causes of natural Things, than such as are true, and sufficient to explain their Appearances.”

“To this Purpose the Philosophers say, that Nature does nothing in Vain, and more is in Vain when less will serve; for Nature is pleased with Simplicity, and affects not the Pomp of superfluous Causes.”

Princip. Book III. Rule I. p. 202.

Nor am I yet sensible wherein I transgress Sir Isaac Newton's Rules, in proceeding to Inferences and Conclusions, after having made Experiments with due Attention, for this also is what I am taught by that greatest of Philosophers.

“In experimental Philosophy we are to look upon Propositions, collected by general Induction from Phænomena, as accurately, or very nearly true, notwithstanding any contrary Hypotheses that may be imagined, till such Time as other Phænomena occur, by which they may either be made

“more

" more accurate, or else liable to Exception." *Princip. Book III. Rule IV. p. 205.*

The same Rule Mr. *Martin* thus explains: " Propositions and Conclusions deduced from actual Experiments, must be esteemed true and accurate, notwithstanding any Hypotheses, or received Suppositions to the contrary ; and must be insisted on, till some other Phænomena, either render them more accurate, or liable to Exception." *Philos. Gram. Edit. II. p. 16.*

Consequently according to such Reasoning, I have not only a Right to insist on my general Conclusions, but it is my Duty : I am told, I must insist on them till some other Phenomena, either render them more accurate, or else liable to Exception ; therefore till then, they must rest where I have left them.

This Rule " Sir *Isaac Newton* tells us must be observed, that the Argument of Induction may not be evaded by Hypotheses;" consequently if they are not to be evaded by Hypotheses, much less are they to be evaded by what falls so much short of an Hypothesis, viz. a loose indeterminate way of arguing, supported with no one single Proof.

Again. " If no Exception occur from Phænomena, the Conclusion may be pronounced general.— But if at any Time afterwards any Exceptions shall occur from

" Experiments, it may then begin to be
 " pronounced with such Exceptions as oc-
 " cur." *Optics*, Edit. III. p. 380.

Such generous and sound Reasoning is highly worthy of its great Author; here is good Quarter allowed to the Experimentalist, with Encouragement for him to proceed in his Researches, instead of using all the Means in his Power to intimidate him who is endeavouring to propagate what he has experienced in useful Knowledge.

Having thus far proved the Validity of my grand Assertion, to wit, that the electrical Fluid, and Sir Isaac Newton's Æther, are one and the same Thing, it is presumed I may take it for granted; especially since there is not the least Shadow of Probability of any other Fluid like this, residing in the Pores of gross Bodies; endued with all the Marks and distinguishing Characteristics of Æther; and which, according to Sir Isaac Newton's first Rule of Reasoning above-mentioned, must be unphilosophical to suppose, * as will farther appear: I shall therefore henceforward, suppose them one and the same, and
 semie-

* Sir Isaac Newton exposes the Opinion of two distinct Æthers in Nature, his Words are,

" How two Æthers can be diffused through all Space,
 " one of which acts upon the other, and by Consequence is
 " re-acted upon; without retarding, shattering, dispersing
 " and confounding one another's Motions, is inconceivable,"
Optics, Quæ. 28.

sometimes call the electrical Fluid by the Name of Æther.

That those Gentlemen are egregiously mistaken; and that what they assume and take for granted with such an Air of Assurance, (*viz.* that to explain Electricity the *Newtonian* Principles are absolutely necessary) has no Foundation, will more plainly appear by instancing in a few other Particulars.

Sir Isaac Newton's Axioms, or Laws of Motion, it is presumed, are allowed as fundamental Principles, and yet how repugnant to the Laws observed by the electrical Fluid, do some of them appear, when compared therewith; namely,

1st. Law of Motion of the Inertiæ of Bodies.

" *Every Body perseveres in its State of REST, or of UNIFORM MOTION in a right Line.*" Princip. Book I. p. 19.

But neither Philosophers or Experience inform us, that the subtle fluid Æther is ever at rest; on the contrary, Philosophers always speak of it as restless, and in perpetual Motion, but not in uniform Motion, and in a right Line; and it may be truly said, that instead of the Inertiæ, (common to all gross Matter) nothing appears in the electrical Fluid, but real Activity. Again,

3d. Law of Motion on ACTION and RE-ACTION.

"To every Action there is always opposed an equal Re-action; or the mutual Actions of two Bodies, upon each other, are always equal, and directed to contrary Parts."

Page 20.

This Axiom, although never observed to deviate with respect to gross Bodies ; not only as to those Bodies among themselves, but between gross Bodies and the Air, or Atmosphere likewise, which both resists, and is also resisted by grosser Bodies ; but the electrical Fluid is so far from being resisted by gross non-electrical Bodies, that it is observed to penetrate their Pores with the greatest Freedom ; and what is the most wonderful of all, is, that the more dense and compacted the gross non-electrical Bodies are, with so much the greater Facility the electrical Fluid flies, or rather darts through them, as is manifest in the most dense Bodies of all others, even Gold itself ; through the minute Pores of which it passes, with the utmost Freedom, and we are always sensible of the greatest Effects in the Leyden Experiment, when the electrical Fluid is conducted through those densest, non-electrical Bodies.

If

If then the gross Matter of which those dense Bodies are composed, be no Impediment to the Progress of the fine Fluid passing through it, consequently those grosser Bodies will meet with no Resistance from that ; agreeable to the same third Law.—Then, may we not safely conclude, that one essential Property of Æther, is that of not resisting the Motion of gross non-electrical Bodies.

C O R O L A R Y.

Hence one of the greatest Paradoxes in all Nature, will be exemplified ; namely, why the non-electrical Planets may preserve their whole Motion, although performed in the midst of a Plenum, of such a subtile Medium.

Once more, to illustrate and confirm the above Reasoning: All Bodies composed of gross Matter, constantly point out an attracting, or gravitating Tendency towards each other ; while on the contrary, nothing can be much more obvious than that repelling Force which ever subsists between the several Parts of this subtile Fluid. *

Many

* But although the Particles of the electrical Effluvia so manifestly appear to repel each other, yet they do not, in a strict Sense, seem to repel so much as the smallest Particle of non-electrical Matter ; for although we so frequently see them

Many other Instances of the like Nature might be produced, but this small Specimen, it is presumed, is abundantly sufficient to prove it to be governed by quite different Laws from those of common Matter, and consequently that the *Newtonian Principles*, are not so necessary to explain and account for Electricity, as these Gentlemen imagined.

Upon this Principle, *viz.* that Action and Re-action do not obtain and take Place between the electrical Fluid and non-electrical Bodies. Many other Things equally surprising will be discovered, and so far from appearing as Paradoxes, that, on the contrary, they will flow like so many natural Consequences; such as why the Guinea and downy Feather still descend with equal Velocity, in a Receiver exhausted of Air; although at the same Time so great a Quantity of this subtile Medium be conveyed into it as to become visible, and appear luminous: As also why the Mercury in the Gage of the Air-Pump, is not depressed by so great a Quantity of the most elastic Principle in all Nature; notwithstanding, if the least

Quan-

them repelled in the electrical Experiments, this is not till they have been electrified, and by that Means furnished with an electrical Atmosphere, which they have no sooner parted with, but that (if in the Sphere of Attraction) they immediately return back to the excited Apparatus again.

Quantity of Air be introduced into the Receiver, it is sufficient to depress it.

Query. What then must counterbalance so surprizing an elastic Force of a Fluid, which in its natural State is observed to be 700000 Times greater than the elastic Force of the Air? † Can any Thing but the circumambient Atmosphere be sufficient, since we find by Experience that the Particles of the Quicksilver in the Gage, are not capable of it.

If it be replied, the Atmosphere has no direct Communication with the Vacuum, at the upper End of the Gage; it may be answered.—The homogeneous Particles of the Æther contained in the Pores or Vacuities of the Column of Mercury in the Gage, communicate both with the Æther in the Vacuum at the upper End, as also with the Atmosphere at the lower End, and by that Means serve as a Fulciment, or Prop to the one as well as the other; consequently, as surely as the Air is capable of resisting and counterbalancing the Particles of Æther at the lower End of the Column of Mercury, ‡ so surely will the whole be counterbalanced.

D

Thus

† This appears to be Fact from a just Calculation of Sir Isaac Newton's, in the 21st Quæ. of his Optics.

‡ There is not any Experiment wherein the Atmosphere does not appear capable of counterbalancing the electrical Fluid.

Thus we find the common Air to be capable of resisting and counterbalancing, not only the ponderous Column of Mercury in the Gage, but also the greatest Quantity of this elastic Fluid in the Vacuum : The former of which is performed by its Pressure, or Weight, and the latter by its repelling Quality as an Electric per se.

I shall not pretend to say, that because I have observed that Action and Re-action do not obtain and take Place between Æther and gross Matter, that it is therefore a Discovery ; because if the Æther be a Spirit, as Sir *Isaac Newton* affirms, the rest must follow as a natural Consequence ; this being agreeable to our Idea or Conception of a Spirit, *viz.* that a gross Body is not capable of resisting it.—But although I am not so arrogant as to claim the Discovery, yet I can truly assure the Reader, I never observed it to be taken Notice of by any one before.

The Theory of most other Discoveries and their Improvements, that have been made in either Nature or Art, are so easily attained by Reading, that an elegant Novice has oftentimes appeared superior in Skill to an experienced Artist with whom he had been disputing ; but in electrical Enquiries this is not to be done : For Electricity being so lately arrived at its present Perfection, few Helps are to be expected from Books only ; particularly as no Authors who treated of it before

before the *Leyden* Experiment could possibly say any Thing of it so very extraordinary, as since.

To say the Truth ; the feeble State in which Electricity appeared before that Experiment was discovered, conveyed no Ideas of any considerable Force, nor was it so much as suspected by Sir *Isaac Newton* himself, as plainly appears from his own Account of it : Who, when speaking of Light, Fire, and Electricity, was so far from thinking this electric and elastic Fluid to be the same with his powerful electric and elastic Fluid, that he tells us,

“ If a glass Globe be put into a Frame,
“ and turned swiftly round its Axis, it will,
“ in turning, shine where it rubs against the
“ Palm of ones Hand applied to it : And
“ if at the same Time, a Piece of white
“ Paper, or a white Cloth, or the End of
“ ones Finger be held at the Distance of about
“ a quarter of an Inch, or half an Inch
“ from that part of the Glass where it is
“ most in Motion ; the electric Vapour which
“ is excited by the Friction of the Glass
“ against the Hand, will, by dashing against
“ the white Paper, Cloth or Finger, be put
“ into such an Agitation, as to emit Light,
“ and make the white Paper, Cloth or Fin-
“ ger appear lucid like a Glow-worm ; and

" in rushing out at the Glass * will sometimes push against the Finger so as to be felt. — And the same Things have been found by rubbing a long and large Cylinder of Glass or Amber, with a Paper held in ones Hand, and continuing the Friction till the Glass grew warm." *Opt. Quæ.* 8.

Was not this a very feeble State : Was it not morally impossible he should imagine that that which exhibited but little more Light than a Glow-worm, was capable of being rendered more like that of the Meridian Sun † ; or that which appeared with a Force but just sufficient to be felt against the Finger, was yet capable of being so increased, as to be equal to a Force sufficient to overturn a Mountain ‡ ; or prove fatal to a whole Army of men in an Instant, which might now be compleatly effected, if the *Leyden* Experiment were to be made with a sufficient Number of Mr. *Franklin's* large glass Jars in the Place

* This, which was then thought to rush out of the glass Globe, has since been discovered to rush out of the Hand, Fingers, &c. as is evident not only from Experiment the First of my former Essay, but from numberless others, particularly by Mr. *Rackstraw's* Thirty-fifth Experiment, performed with his sulphur Globe, p. 51. of his Essay.

† See Mr. *Rackstraw's* Essay, p. 65, 66.

‡ It is the Opinion of Mr. *Franklin*, from what he has experienced with his large glass Jars, that the greatest known Effects of Lightning, may, without much Difficulty, be exceeded by the Fire of Electricity. See his Letters, p. 94.

Place of the Vials, and a whole Army of Men to join Hands and form the Circuit; and what is yet more strange, is, that if the Force be but increased to such a Degree as to kill a single Man, which all Electricians very well know to be practicable; so surely would it, (for any Thing that ever appeared to the contrary,) kill every one in the Circuit, were there ever so many.

As these, and many other Things in Electricity equally surprising, are so manifest as not to be denied, and yet to be met with in very few Authors; it must follow, that none but the Electrician himself, can be a competent Judge of the Ability of others in the electrical Way.

N. B. Having been represented so mean a Philosophaster as to be quite ignorant of the common Principles of Philosophy, and as those Gentlemen seemed to think, of all Kind of Science: I hope for this Reason to be excused by the candid Reader, if I should inform the Monthly Reviewers, that although I own myself to be no Adept in Literature, strictly so called; yet am I not an entire Stranger to Philosophy, nor to mathematical Learning; even to the analytical Art, and may therefore be capable of reading (at least) not only the *Principia* in general, but the analytical Demonstrations likewise; so that if I am such an entire Stranger to the *Newtonian* Principles

Principles as I am represented, it must be altogether my own Fault.

But although Sir *Isaac Newton* seemed so thoroughly convinced, that such a certain most subtle Spirit, constantly resides and lies hid in the Pores of all gross Bodies ; yet as this could never be clearly proved to the Senses, before the Discovery of the *Leyden* Experiment ; as he had no Method to give ocular Demonstration, even of the Existence of any such active and powerful Agent ; it was no Wonder if such a Doctrine was disbelieved, and treated rather like a Dream than real Fact, at least so with the Bulk of Mankind : And to say the Truth, the only principal Difficulty, all eminent Philosophers laboured under when treating of this Subject, was want of proper Experiments to demonstrate to the Senses, that such a subtle and elastic Agent really and actually existed ; for if this could have been but once effected, few seemed to doubt of the powerful Effects ascribed to it.

This Difficulty then, which always appeared so insuperable, is at length, by Means of Electricity, most happily surmounted ; and such an astonishing, powerful, subtle, and elastic Fluid, is actually discovered to exist, and this not by Halves, but if possible, much to exceed all that was ever conceived of it : And never was any Phænomenon exhibited to Mankind in a more favourable Manner for

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Examination than this. Few Experiments can be wished for, which may not be most easily made. No Experiment, of whatever Kind, can be made in any Branch of natural Philosophy, that in general appears more convincing, and consequently more conclusive ; and although it must have appeared so difficult a Task to prove what Sir Isaac Newton affirmed of it, namely, that it pervaded and lay hid in all gross Bodies ; yet this is by Means of those modern Experiments so clearly and evidently proved, as to be put beyond all Dispute.

In a Word, we are blessed with every necessary Requisite, and permitted to torture it with Experiments in whatever Manner we please, in order to bring it to a speedy Confession of its Nature, Properties, and Use to Mankind.

Quæry. As the electrical Fluid is allowed by all, to be the most wonderful Phænomenon that ever came under ocular Inspection, and as, in general, the greatest and most remarkable Discoveries have constantly pointed out some useful Purpose, or valuable End, can it be reasonably supposed, that the great Revealer of SECRETS should conduct Mankind to the most surprising and wonderful Discovery that was ever known, to serve no other Purpose than merely to amuse them ?

May we not safely infer, that as surely as Nature never acts in vain, so sure are we that

that so superlatively great a Discovery or Revelation (if I may be allowed to call it so) was never made to serve so vain an End only, but rather Ends proportionably great? Consequently, if Means and Ends are proportionate, and if all the Operations of Nature are in just Proportion of Number, Weight, and Measure, the greatest ENDS of all others are here designed.

It is presumed this grand Discovery will not (particularly by the judicious Philosopher) be esteemed the Effect of blind Chance only; that the remarkable Blow which was first felt by the famous Professor *Muschenbroek*, was merely accidental; or that the Earth and its numerous Inhabitants can be thought so inconsiderable a Part of the Creation, as that the Hand of divine Providence should have no Share in so remarkable a Transaction (a Privilege, which perhaps the Inhabitants of no other Part of the whole solar System may be yet favoured with) for this might justly be censured as no small Mark of Infidelity.

But the Manner alone, by which the Knowledge of the great Power and Force of Æther, was at first communicated to Professor *Muschenbroek*, was most remarkable; for no Experiment since that, of the same Kind, and made after the same Manner, ever appeared so formidable; where the Vial was small, and furnished most probably with cold Water, and unarmed, viz. unassisted with

a metallic Coat, according to the present Method of Improvement made Use of to increase the Force ; yet, under all these disadvantageous Circumstances (as he informs us) he received so violent a Blow, that he thought himself nearly expiring, and therefore could by no Means prevail with himself to repeat the Experiment.

That Experiment appearing so widely different from all that have been ever made of the same Kind, and shewing so much greater Force than any one that has ever been since attempted, when no Art was made Use of to increase the Force, *Query*, Whether this ought not to be esteemed a sufficient Hint to inform us, that that Phænomenon in particular, came not but by a special Commission ?

And although I must own myself indebted to those Gentlemen Enquirers, for allowing, not only that my Title Page is a true Epitome of the whole Performance, and consequently a just Title ; but particularly, that I have delivered my Sentiments with Candour and Sincerity, which will be allowed to be no despicable Character as an Author.

Yet, since the next Words are designed as the greatest Detraction, it will be necessary to go over the chief Things again, to discover either wherein I had failed in the Attempt (since they have not done it) or else to illustrate and confirm the same.

The principal Things advanced in my Title Page are,

1st. To prove that the Fluid brought under ocular Inspection, by Means of the electrical Apparatus, is the very Æther of Philosophers.

2dly. The Cause of that remarkable Difference between electrical and non-electrical Bodies.

3dly. From whence the electric Matter is derived, or the Source from whence it proceeds.

4thly. It's Benefit to the human Body when applied as a Remedy to Diseases ; each of which has been again strictly examined.

First then, That the electrical Fluid is the very Æther, 'tis presumed is what is now questioned by few Philosophers ; although when I wrote that Pamphlet it did not seem so generally allowed ; and to say the Truth, I was for that Reason under some Apprehension of being publickly chastised (if thought worthy of Notice) for affirming it so confidently, because I was so audacious as to be the first who had ventured to speak his Mind on that Head so freely, at least, that I ever knew of, although several had hinted the same Thing before, particularly the ingenious Mr. *Wilson*, in a former Treatise on the electrical Fluid, who shewed it so plainly to be his real Opinion, and his Arguments so convincing, that I could not help admiring his Opinion

nion was not more generally received, notwithstanding the great Modesty with which he delivered his Sentiments : Others still more cautious, only affirming the Æther to be the *Cause* of the electrical Phænomenon : For these and such-like Reasons, I was determined, at all Events, to venture and speak my Mind without any Reserve, especially as I was so sure I could confirm my Arguments by the most convincing Experiments.

But, contrary to my Expectation, no one that ever I heard of, condemned me for it. And to my still greater Satisfaction, about the same Time my Pamphlet was published, came out the Observations on a Series of electrical Experiments, by the learned Dr. *Hoadly*, in Conjunction with the abovementioned Mr. *Wilson*; wherein they expressed their Sentiments more fully than I had ever seen in any Author before, affirming it unphilosophical to suppose, that the Æther of Sir *Isaac Newton*, and the electrical Fluid, were two distinct Fluids: 'Tis true, they softened the Expression, by saying it was much more philosophical to suppose them one and the same Fluid, than to suppose them two.

The Manner in which they express themselves, is as follows:

" Thus have we gone through the most
" interesting of the electrical Experiments,
" and from the various Appearances they

“ afford, it appears, that the electrical Fluid
“ is as universal and powerful an Agent at,
“ or near the Surface of the Earth, as that
“ Fluid which Sir Isaac Newton, in his Op-
“ tics, calls Æther; that it is as subtle and
“ elastic in its Nature as Æther is; and as
“ Æther does, that it pervades the Pores of
“ all Bodies whatever that we are con-
“ versant with; is dispersed through what-
“ ever Vacuum it is in our Power to produce
“ by Art; and from the natural Phænomena
“ of Thunder, Lightning, &c. seems to be
“ extended to very great Distances in the
“ Air.

“ We shall make no Scruple therefore
“ now to affirm, that these two Fluids are
“ one and the same Fluid; and it is much
“ more philosophical to do so, than to sup-
“ pose two such Fluids, each of them equally
“ capable of producing these Effects, and
“ equally present every where, which would
“ be multiplying Causes, where there is no
“ Manner of Occasion,” Dr. Hoadly’s and
Mr. Wilson’s Observations on electrical Expe-
riments, p. 58.

2dly. As to the Description of electrical
and non-electrical Bodies, I have perused it
again and again, and often compared the
Description and Experiments together, and
can truly say I find nothing asserted, but what
is strictly agreeable with Experience; conse-
quently, according to Sir Isaac Newton’s 4th
Rule

Rule aforementioned, the Conclusions are to be admitted, till Exceptions, founded on Experiments, or at least, on more rational Arguments, can be brought to shew their Insufficiency.

The 3d Thing to be re-examined is, from whence the electrical Fluid is derived, or the Source from whence it proceeds.

The principal Experiment made Use of to shew this, and to prove it to be from the Earth, is at Page 19, of my Pamphlet; where, instead of a Cushion, a Hand was supposed the Instrument of Friction, on the prime electrical Glass Globe; and is as follows.

EXPERIMENT I.

Tending to point out the Source, or main Spring, from whence the electric Matter is derived.

IF a Person standing on the Floor, lay his Hand on the Glass Globe in Motion, the electrical Matter is produced in great Plenty, as we find by its acting so vigorously on the Gun-barrel, or other Apparatus of Wires; but if he steps on a Cake of Resin, &c. it is very much weakened, and very little Fire or Attraction is to be found on the same, notwithstanding the Friction be continued at the Glass Globe: To prove that this is no Deception,

ception, let him put a Foot again to the Floor, and they will, that Instant, act vigorously as before, and be again as instantly deprived of great Part of that Power at lifting it up again ; and *vice versa*.

When I began again to examine this Experiment, I soon found it capable of Demonstration by many other Methods, as,

1st. If this Phænomenon be produced from the Earth, as I had supposed ; then it must follow, if the Person on Resin, while rubbing the prime electrical Glass, put his Toe to the Floor, that the Fire will necessarily appear between them, if the Room be darkened. This Experiment, when tried, fully answered my Expectation, especially if the Shoe were of ; and much plainer yet, if a Finger of one on the Floor were brought to the Foot, for then it was not only visible, but it might be plainly felt and heard to snap or explode at passing from the Finger to the Foot ; and thus the Certainty of what I had undertaken to prove by the Experiment, was compleatly demonstrated, by being realized to no less than three of the Senses at once.

2dly. If the Person with his Hand on the Globe, stood on folded Woollen instead of Resin, it was sufficient ; for then, likewise, it might be seen and felt, if a Finger were brought to the Sole of the Shoe.

3dly. If a Person rubbing the Globe, stood on a Chain when folded together, the Fire,
at

at passing from the Floor to the Foot, appeared between several of the Links. And,

4thly. I have observed it (when the Weather was favourable) to appear between the Fingers and the Sole of the Shoe, even if he stood on the Floor and the Sole of the Shoe perfectly dry.

But if a Finger of a Person be brought to his Hand or Face when mounted on Resin, it appears to act with the greatest Force of all.

From these Hints the Electrician will be sensible, how the Experiment may be varied many other different Ways, each of which serves to strengthen and confirm the Theory.

Hence then, as it is so undeniably produced from the Earth, we shall find that the Person rubbing the Glass, is possessed of the same attracting Quality as the Glass which he rubs, whenever he steps on the Resin ; for as the Friction on the Glass is continued, and consequently the Attraction, and yet can have no Supply from the Earth by reason of the Resin-Cake which intercepts it ; the Attraction is communicated from the Glass Globe not only to the Palm of the Hand in contact, but diffused from thence all over his Body, and accordingly every Part of him attracts any light Bodies that are near very vigorously, and he appears as positively electrified, as if it were really so, although this can be no more than in Appearance ; for he is so far from su-

per-

40 Electricity rendered useful.

per-abounding and being enveloped in an electrical Atmosphere, that he is (if I may so say) in a State of real Want*. — This Appearance is no Way lessened, even although a Person on the Floor were to lay his Hand on the prime Conductor, or other Part of the Apparatus, which is a plain Proof the Appearance is only negative; for if he were positively electrified as in the common Way, the Hand of the Person on the Apparatus would effectually take it all off.

I am acquainted with an ingenious Electrician, who is of Opinion, that the electrical Fluid is collected out of the Air; and that, what convinced him it was not from

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* It does not appear from Experiment, that any particular Body can be actually divested of any Part of that Quantity of this Fluid, which is by Nature assigned to it. It must be owned, non-electrical Bodies suffer a Change of it, but no otherwise than for an equal Quantity, as is manifest by the second Experiment of the Subtile Medium proved, Page 21. in like Manner as when Air passes freely through a Tube, which is always replete with Air, and yet constantly passing out.

Electrical Bodies have likewise always the same Quantity which Nature has assigned them; but the Quantity in those appear rather fixed, or as Mr. Franklin expresses it, they retain strongly and obstinately: Consequently, if Bodies part with none of that due Quantity residing in their Pores, neither can any greater Quantity be added, without doing Violence to Nature, which is always the Case in the *Leyden* Experiment; particularly when the greatest Quantity from Mr. Franklin's Set of large Jars are discharged through the smallest Wire: For it does not appear from Experiment, when any particular Body is electrified, that any Quantity is added to it, otherwise than by Accumulation, which, by Degrees, dissipates into the Air.

the Earth, was because he could make all the usual Experiments with the Glass Tube, while standing on the Resin-Cake as while standing on the Floor, and rubbing it, insomuch as to Fire the Spirits ; but this can prove no more than that he is negatively electrified in the same Manner as the Person rubbing the Globe on Resin, who is as capable of firing the Spirits as in the common Way.

But notwithstanding this subtle Fluid so plainly appears to be produced from the Earth, and propagated to the rubbed Zone of the glass Sphere, through the Instrument of Friction and interjacent Body, whether it be the Body of the Person whose Hand is the Instrument, or whether the interjacent Body be the Frame of the Machine, which must always be the Case, when a Cushion is made Use of for the Instrument of Friction, as it generally is ; yet the Reason of that great Propensity in the subtle Agent, to arrive at the rubbed Part of the revolving Glass, does not so plainly appear ; nor will it perhaps be easy to investigate the Cause, so as that it shall seem natural, without recurring to the Dawnings or first Appearance of Electricity in the World ; which, as it then afforded only a mere Glimmering of what is since discovered,

Quæry, Must not this be a Glimpse of the Primum Mobile, or most prevailing Property, since what was then pointed out is pre-

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sumed to be the most predominant Principle ? which, although it was no more in those early Times, than a faint Attraction that appeared to be formed at the Surface of the Amber by rubbing it, yet was it even in this minute State, sufficient to fix the Attention of the Curious, and was what gave Rise both to the Birth and Name of Electricity ; and accordingly all those Things which were afterwards observed to be endued with the like Quality of Attraction by rubbing them, were called electrical Bodies.

In this minute State Electricity continued for many hundred Years, and might perhaps have ever remained so, had not Mr. *Hawksbee* happily discovered, that such Attraction in the rubbed electrical Body was capable of great Improvement ; insomuch, that if a glass Tube were rubbed with the Hand, and then brought within twelve or fourteen Inches of Bits of Leaf Gold, &c. they would be briskly attracted up to the rubbed Part of the Tube. See Mr. *Hawksbee's* Experiments, Edit. 2d. P. 53.

This great Discovery was much improved by Mr. *Stephen Gray*, of the *Charter-House* ; he it was who gave the first Hint, that electrical Attraction was capable of being propagated to any indefinite Distance, having himself proved it to the Distance of 800 Feet, by properly suspending a non-electrical Line of the same Length, and applying a glass Tube,

Tube, when rubbed, to one End of it, and light Bodies were attracted almost instantly at the other End ; nor is it much less surprising to behold, how great an Attraction is often-times communicated to the glass Tube by only one Stroke of the Hand.

And as all other Effects are so greatly increased, when Experiments are made with the glass Sphere revolving on its Axis, so no Doubt can be made, but that the Attraction likewise of the latter is proportionably greater than that of the former.

What can be more wonderful and surprising than that attracting State, those vibrating Particles (contained and fixed in the internal Substance of original Electrics) are put into, by any violent Agitation at their Surfaces, especially when we consider how powerfully, as well as visibly, the Particles of Æther, are thereby drawn from neighbouring non-electrical Bodies ? A remarkable Instance of this Kind is to be seen in Mr. *Rackstraw's* Essay on Electricity, P. 51 ; I mean his Experiment with the sulphur Globe, which, if the Fingers of a Person standing on the Floor, were held over it while in Motion, Streams of the original Æther, in great Abundance, issued from the Pores of the Fingers on the Globe, although at three Inches Distance, exhibiting so great a Light and Hissing at rushing violently against the Globe,

as greatly to surprize the Person who made the Experiment : nor can the Truth of this be suspected, it being one of the Experiments he made in Public. And is it not remarkable, that notwithstanding this great Attraction at the Glass Tube or Globe, so far as we can judge from Experiment, no Part of it actually enters their Substance, unless the Air be first exhausted ; then, indeed, it pervades the Glass with the greatest Freedom, and the Accumulation, which before was entirely on the outside, is, after the Exhaustion as entirely within their void Cavity, as is manifest from Mr. *Hawksbee's* Experiment above-mentioned, Page 45, and his Experiments with his Glass Tube, Page 61.

According to the Method proposed at Page 52. I should next proceed to re-examine that Part of my Pamphlet relating to the Cure of Diseases by Electricity ; but I find it necessary to go over the second capital Experiment again : Not that I have discovered any Error therein (for on the contrary, I observe it to agree strictly with Experience) but chiefly, lest what I have there proved, and shall therefore take for granted, may look like begging the Question, when I may have Occasion to mention it ; I mean, that the electrical Fluid actually passes through the Pores of dense non-electrical Bodies, and not over their Surfaces ; therefore, as the Pamphlet cannot

cannot be supposed always ready at Hand, I beg to repeat the whole Experiment, with the Observations thereon.

EXPERIMENT II.

The subtle Medium proved; Electricity unveiled; or an Experiment tending to prove what it really is; also its great Inclination to return into the Earth from whence it came.

IF Wires are supported with silken Strings to any given Length whatsoever, and then electrified, although they will shew as great an Energy, and produce as smart a Crack or Explosion, at the greatest Extremity as near the Machine, particularly if the Air and silk Supporters are very dry; yet if they are touched but with a Finger of a Person standing on the Floor, at the same, or any other Distance, the whole Length of the Wire will be, that Moment, deprived of its electrical Virtue; and not the least Sign of Fire or Attraction will be found at any Part of the Apparatus, and will be again as instantaneously restored to its former Activity by taking off the Finger.

What Experiment can possibly prove any Thing more effectually, than this does that
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of extreme Subtilty and inconceivable Velocity?

For although when a Finger is on, even at the farther End, no Fire or Attraction is to be found throughout the whole; yet it must, at the same Time, be undeniably passing through the internal Parts of the Wires, and thro' the Person into the Earth, otherwise it could not again so instantaneously accumulate, and form an Atmosphere on them at removing the Finger: Or, if instead of removing the Finger, he steps upon a Cake of Resin or Bees-Wax, the Effect will be the same; and again, if he but touch the Floor with one of the Toes of his Shoes, while standing on the Resin, and a Finger on the Wire, the whole will again, that very Instant, be deprived of its Activity, and so continue as long as he either keeps his Foot on the Floor, or if but touch a Person with a Finger of the Hand, at liberty.

Quæries.

Does not the Air in this Experiment act the Part of an electric *per se*, and that in a most remarkable Manner? Were it not so, in all Probability, there never could have been the least Appearance of what is called Electricity; it must necessarily vanish into it again as soon as excited, notwithstanding the contiguous Wires and silk Supporters; but instead of that, does it not cling and accu-

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mulate on the Wire, as we find by its attracting light Bodies ; forming an Atmosphere to a considerable Distance from the enveloped non-electric Body, rather than depart again into the heterogeneous Mass, from whence * Part of it seems just collected ? And will it not, as it were, suffer itself to be taken Captive in the Condensing-Vial, rather than return into the Air ?

And does it not seem to have as great a Propensity to escape into the Body of the Earth, as a Reluctance towards returning into the Air ? Does it not, at the Touch of a Finger, &c. though at the greatest Distance, dart that Moment into the Earth, through the Person and all the intermediate Wires ; or if by this, or any other Means, these Wires are brought in contact with any non-electric which has a Communication with the Earth, the Effect is always the same, and not the least Sign of Fire or Attraction is to be found on any Part of the Apparatus ?

Does not the original Æther in this Experiment, quit the internal Parts of the Wires, and give Place to the newly collected Æther, or electrical Fire, to enter and occupy the same

* Although the principal Part of the electrical Fluid is so undeniably attracted from the Hand, and supplied from the Earth, yet some small Portion may probably be collected from the Air likewise, when passing between the Hand and revolving Glass.

same Space, and, consequently execute the same Office, which it must necessarily do, all the Time the Wire has this supposed Communication with the Earth, and the Machine in Motion? And does it not, as it were, leap into the Earth through the Person and the internal Parts of the Wires, so instantaneously, as not to allow Time sufficient to accumulate or form any Manner of Atmosphere on the external Parts? For if the smallest Degree of Accumulation were on the external Parts, some small Degree of Attraction would be also found, which yet is not the Case.

Does not the electrical Fire as effectually pass from the Machine through the internal Part of the Wire, and through the Person into the Earth, as surely as Water is conveyed through a Pipe, all the Time the Machine is in Motion, and the Person with his Finger on the Wire? And is not this Communication with the Earth as effectually separated by his stepping on the electrical Cake, since the whole Line that Moment acts vigorously?

What much adds to the marvellous Part is, that the Wires being touched, though at the greatest Distance, should so affect it, as to put an entire Stop to the Appearance of either Fire or Attraction, throughout the whole Length of the Line, as effectually as if done ever so near the Machine.

Upon

Upon the Whole, if this Experiment alone is not allowed to be conclusive, I should be very glad to be informed of the Reason why? particularly, if we are to suppose with Sir Isaac Newton, that the Pores of the Wires were replete with the Particles of Æther, before the Machine was in Motion: If the electrical Fire were not actually the same Substance with the Æther, why would the original Æther, in the Pores of the Wire, be found so naturally to rush out first into the Earth, and give Place to the electrical Æther to follow it? For it is imagined it will not be replied, there was Room enough in the Wire for both, or for the electrical Fire to pass by the Side of the original Æther, contained in the internal Parts of the Wire.

I have insisted the more on this Experiment, because, though it is most easily performed, yet no Experiment can well be more clear and conclusive, or prove any Thing more effectually than this does, that they are one and the same.

Note, Although those Inferences are put as Quæries, yet was it not because they were incapable of farther Proof, even that abstruse one above-mentioned, viz. "Does not the electrical Fire as effectually pass from the Machine, through the internal Part of the Wire, and through the Person into the Earth, as surely as Water is conveyed through a Pipe all the Time the Machine is in Motion, and

" a Finger of a Person on the Floor at the Extremity of the Wire."

This Quæry may perhaps be thought incapable of any Kind of Proof; yet is it so far from it, as to be capable even of ocular Demonstration by the following easy Method:

Let any Part or Parts of the excited Apparatus of Wires, &c. be supported in such a Manner that they may be clipped asunder, or otherwise divided, without dropping one from the other at each Division, and the Fire will be plainly perceived to move from the one to the other, at every Part so separated.

Note, The accumulated Fluid on the Apparatus, shewing so remarkable a Tendency to escape into the Earth, was a sufficient Hint that it was first produced from thence.

Having proceeded thus far in Vindication of my former Essay, as I thought such Vindication my Duty; so on the other Hand, as I am conscious of having been guilty of an Error in explaining the *Leyden* Experiment, I think it no less my Duty to confess and retract it, particularly as I never observed it to have been detected by any other Hand; the Mistake was this.

I had supposed the Motion of the electrical Fluid along the Circuit to be performed in just a contrary Course and Direction to what is since discovered, and should therefore think myself inexcusable, were I to justify, or even

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to pass over in Silence that which I have since discovered to be absolutely false *.

What led me into the Error was, that remarkable Congruity observed among the Parts of all, or most homogeneous (common) Fluids; I mean that remarkable Propensity of uniting and incorporating with each other, which appears to be a Law or Rule so generally observed among those Fluids, as to admit of few, if any, Exceptions.—For want of due Consideration, I imagined that so universal a Law must consequently prevail among the homogeneous Particles of the electrical Fluid likewise, whereas I ought to have first enquired into the Cause why the former so readily unite and incorporate, which appears to be from an attracting Property of the Parts in contact; for this would have informed me, that the same Law was inconsistent in the present Case, because the Particles of this elastic Fluid are observed to repel each other, in as remarkable a Manner as those of common Fluids attract; and consequently, that the Motion or Direction of the Fluid is the contrary Way to what I had supposed it.

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* It must undoubtedly be the indispensable Duty of every one, who is desirous of contributing his Mite to the public Fund, or common Stock of Knowledge; (that is, every faithful Author) whenever he discovers that he may have committed any remarkable Mistake, to take the first Opportunity of retracting it: For this Reason, as I have published the Mistake, so I very gladly make Use of this Opportunity to confess it as publicly.

This Error must necessarily be the Cause of others ; and it became absolutely necessary to re-consider the whole Experiment ; which I shall endeavour to perform in a clear and intelligible Manner, omitting nothing on this abstruse Subject, that may appear conducive to the End proposed, namely, to shew in what Manner this amazing Violence, and circulating Shock is produced and propagated.

Note, My present, as well as former Hypothesis, is founded on the Supposition of a Vacuum (consequently, that so far the former is supposed to be just) this 'tis presumed will appear reasonable, not only because it is not easy to conceive how such Violence can be otherwise produced, but as it will be found agreeable to Experiment : Such Vacuum is supposed to be formed by the sudden Expansion, or bursting of the condensed Æther, arrested and detained in the Vial *: But whether it may really appear reasonable to suppose, that such a Vacuum be actually generated in that Experiment or not, as also that a Vacuum be absolutely necessary to produce the surprising Force we behold in that Experiment, is the first Thing to be enquired into.

According

* The Resistance arising from such a Vacuum, is sufficient to produce any Effect of this Kind whatsoever. Mr. Wilson's former Essay, Page 90.

According to the *Newtonian* Rules, we are to proceed in our philosophical Enquiries by Analogy, and compare difficult Things under Consideration, with those we are more intimately acquainted with, in order to try how far the Analogy will hold good, which is well known to be no unsafe Method in mathematical, as well as in philosophical, Enquiries.

In the present Case, it may perhaps be sufficient to compare Professor *Muschenbroek's* Vial, when charged with the electrical Fluid, to a Piece of Fire-arms when charged with Gunpowder ; in each of which is a Quantity of latent Fire, fixed, and just ready to be set free : The latter is encompassed and confined on all Sides by the Metal, excepting at the open Part of the Tube ; the former is encompassed and confined on all Sides with electrical Bodies, *viz.* the common Air, and the Glass of the Vial.—At the kindling-up of the Fire in the Gun, we observe a remarkable Explosion, and violent Expansion of the elastic Fire ; and since no Place is left free for the Expansion but the open Part of the Tube, the Motion is necessarily performed along that.—In like Manner, at the kindling-up of the Fire in the Vial, we also observe a remarkable Explosion, and violent Expansion, of the elastic Fire ; and as all Parts are guarded by the Glass and the circumambient

cumambient Atmosphere (both electrical Bodies) and nothing contiguous so susceptible or ready to yield to the Impression, as the Æther contained in the contiguous non-electrical Circuit, formed for that Purpose ; the Expansion (as we observe by the Effects) is performed throughout the same Circuit, although ever so greatly extended. And if a Vacuum be formed at the sudden Expansion of the Fire in the Gun,

Quæry, Whether it be not rational to expect similar Effects from two such similar Experiments ? and consequently that a Vacuum is generated in the one Case as well as in the other.

Note, Since the following may very possibly convey an Idea to some Kind of Readers, of the Manner in which a Vacuum is formed at the Discharge of a Piece of Fire-arms, I hope to be excused the Digression, it being what I was once an Eye and Ear-witness of.

In an upper Room of a lofty Building *, I saw near the Outside of the Window a leaden Cistern fixed, which served as a Reservoir to supply the House, on Occasion, with Rain Water ; and for that Reason a leaden Pipe was fixed to the Cock of the Cistern, the other End of which came near the Ground

* Mr. Brodribb's House in Worcester.

Ground at the opposite Side of the Court, to be ready for Use.

The Person * who shewed me the Experiment turned the Cock at the Cistern, and when the Water was heard to discharge itself at the lower End, he re-turned it to cut off a farther Supply of Water from the Cistern: The Consequence of which was, that in a small Time after, a very smart Stroke was heard at the Cock of the Cistern, and as loud as if it had been struck with a Club, or an Iron Bar.

By this familiar Experiment they will readily conceive, not only in what Manner the Report or Stroke at the Cock was performed, but also, that the Effect of it may pass for a full Demonstration, that the Method taken by Philosophers, to account for a Piece of Fire arms, is just; for, as in that, the Fire drives out the Air, and leaves an Emptiness or Vacuum in the Tube, and the external Air rushing in with Violence to restore the Equilibrium, is the Cause of the Report: So in the present Experiment, the Water running out of the Pipe, left an Emptiness or Vacuum behind it, or at least so, in some Degree; but when the Top of the Current was come near the Bottom of the Pipe, the external Air rushing in with Violence to restore the Vacuum, was observed to strike with

* Mr. Berwick.

with such Force against the upper End where it was resisted, much after the same Manner (though with less Violence) as when the Gun is fired ; and doubtless, had it been possible for the Discharge of the Water out of the Pipe, to have been performed as suddenly and as violently as the Fire from the Piece, the Effects had been proportionable.

Quæry, Whether the Water which passed through the Cock from the Cistern was sufficient to fill the Pipe (through which it passed) quite full or not ; because, had there been no Way for some small Portion of Air to insinuate, and get above the upper End of the Current of the Water in the Tube, sufficient to expand itself, so as to push, or drive the Water downward, it could be no more capable of emptying itself than the Mercury in the Barometer.—But to return from the Digression.

As it appears so reasonable to suppose that a Vacuum is instantly formed, at the violent Eruption and sudden Expansion of the condensed Fluid in the electrical Vial, it must seem rational to expect, that such Vacuum is some Way or other as instantly restored, particularly as we perceive such sudden and violent Effects : But before I endeavour to shew how such violent Effects are produced, it may not be unnecessary first to shew the remarkable Propensity of this subtle Agent

Agent to arrive at a Vacuum, and the great Facility with which it pervades the Glass at such Times, more than at any other ; for which Reason I shall mention an Experiment made by the ingenious Mr. *Hawksbee*, with his Attrition-Engine, which differed but little from the present electrical Machine.

“ I took (says he) a glass Globe of about “ nine Inches Diameter, and exhausted the “ Air out of it ; then, having turned a “ Cock which prevented the Return of the “ Air, I took it from the Pump. The “ Globe being thus secured, I fixed it to a “ Machine, which gave it a swift Motion, “ with its Axis perpendicular to the Horizon ; “ and then applying my naked Hand (ex- “ panded) to the Surface of it, the Result “ was, that in a very little Time a consider- “ able Light was produced.

“ And as I moved my Hand from one “ Place to another (that the moist Effluvia, “ which very readily condense on the Glass, “ might, as near as I could, be thrown off “ from every Part of it) by this Means the “ Light improved * ; and so continued to in- “ crease, till Words, in capital Letters, be- “ came legible by it, as has been observed

H “ by

* That same Light was all within-side of the Glass, as we find at Page 48, when he repeated the Experiment; as also at Page 61, when he made Experiments with an exhausted Tube.

“ by Spectators.—Nay, I have found the
 “ Light produced to be so great, that a large
 “ Print might, without much Difficulty, be
 “ read by it.”—And a little farther on he
 tells us, “ The Light was of a curious pur-
 “ ple Colour.” Mr. *Hawksbee's* Experi-
 ments, Edit. 2d. Page 45.

O B J E C T I O N I.

How can we believe this electrical Fluid to be that very fine ætherial Medium described by Sir *Isaac Newton*? Does it not appear in Mr. *Hawksbee's* revolving exhausted Globe, to be rather of a much more cloudy and gross Substance?

A N S W E R.

Sir *Isaac Newton* himself is not of Opinion, that his subtle fluid Medium, is always and every where equally fine and rare, as some may imagine, but of different Density according to its different Situation, as plainly appears from his Letter to Mr. *Boyle*, concerning his Thoughts on Æther and Gravity, where he thus expresses himself.

“ There is one Conjecture more about the
 “ Cause of Gravity. I suppose the Æther
 “ to consist of Parts differing from one ano-
 “ ther in Subtilty by indefinite Degrees :
 “ That in the Pores of Bodies there is less of
 “ the grosser Æther, in Proportion to the
 “ finer, than in open Spaces ; and conse-
 “ quently, that in the great Body of the
 “ Earth,

“ Earth, there is much less of the grosser
“ Æther, in Proportion to the finer, than in
“ the Regions of the Air : And that yet the
“ grosser Æther in the Air affects the upper
“ Regions of the Earth, and the finer Æther
“ in the Earth, the lower Regions of the
“ Air, in such a Manner, that from the
“ Top of the Air to the Surface of the
“ Earth ; and again, from the Surface of the
“ Earth to the Centre thereof, the Æther is
“ insensibly finer and finer.”

But notwithstanding this gross Appearance of Æther, or electrical Fluid, in Places void of Air, yet is its great Subtilty, and powerful Influence, remarkably conspicuous, even where the Air is not excluded : This is plain from that familiar Experiment of covering Bits of Leaf-Gold, or other light Bodies, with a Glass, which will be briskly attracted and repelled by a rubbed Tube held over them, at more than a Foot Distance, although several Books are piled one upon another over the Glass.

Quæry, May not this pass for a Demonstration, that Sir Isaac Newton's Conjectures concerning the different Degrees of its Density, were just.—From the Effects of the above Experiment, and numberless others, it plainly appears that the finest Æther is not only the most subtile, but also the most active and powerful in every Respect.

And notwithstanding the purple Apparition in Mr. Hawksbee's Glass, yet even in that State, how much more rare than Air (or any Thing else, excepting Light) must it be, to pervade the Glass with such Freedom, although Glass suffers not the electrical Fluid to pass through it without Resistance, in the same free Manner as through non-electrical Bodies ; yet to arrive at, and occupy the void Space, it pervades its Pores with the greatest Freedom, which, as the Quantity increases in the Vacuum, so the purple Flame becomes more and more luminous.

And as Æther is allowed by Sir Isaac Newton, and other eminent Philosophers, to be universal, Quæry, Whether that purple Colour be not its natural Hue, in all Places void of Air ; in the immense Void beyond the Earth's Atmosphere, as well as in artificial Vacuums within the Atmosphere ; for this is agreeable to Sir Isaac Newton's Rules of Philosophising, *Princip. Book III. Page 388*, where, when speaking of Mr. Boyle's Vacuum, he argues thus :

“ Bodies projected in our Air suffer no Resistance but from the Air. Withdraw the Air, and the Resistance ceases. For in this Void a Bit of fine Down, and a Piece of solid Gold, descend with equal Velocity, and the Parity of Reason must take Place in the cælestial Spaces above the Earth's

“ At-

" Atmosphere ; in which Spaces, where
" there is no Air to resist their Motions, all
" Bodies will move with the greatest Free-
" dom."

Consequently the same Parity of Reason will take Place, with respect to the purple Colour of the Æther, as well in the cælestial Spaces as in the artificial Void. If then the luminous purple Hue is inherent in the universal Æther beyond the Atmosphere,
Quæry,

Whether the interjacent Atmosphere be not thereby rendered of that Azure or Sky-Colour ?

Lastly, Can there be any more Reason for believing this subtile Fluid to be gross, on account of its Colour only, than there is for believing the Rays of the Sun to be gross, on account of Purple and other darker Colours contained in them, which are so easily separated from them with a triangular glass Prism ?

Experience, which is the best Test of all others, informs us, that those Colours are so far from proving the Rays to be gross, that they seem rather absolutely necessary to constitute that fine clear Brightness we behold in them ; for although the lightest of those prismatic Colours are much darker than what we conceive of the Sun's Rays, yet are they all no sooner compleatly blended together by Means of a convex glass Lens, but

they

they re-assume their primitive Lustre, and appear of a clear sunshine White.

O B J E C T I O N II.

But allowing the *Leyden* Experiment may be so analized, as that it may appear reasonable to suppose a Vacuum, and the Restoration of the Equilibrium were absolutely necessary to the Production of so great a Force, yet, why should such Vacuum and Force be generated in the Vial, notwithstanding the Fire and Explosion appear at that Part only, where the Circuit is compleated, by bringing the Finger, &c. to the excited Apparatus of Wires, although at the greatest Distance from the prime Conductor on which the Vial is suspended?

A N S W E R.

Not only because an exceeding vivid Flash of Light appears at the same Instant in the Vial (provided it be lined with Gold or Silver Leaf*, instead of being furnished with Filings of Metal, &c.) but also because the same Fire, Explosion, and Light, all appear, even though the Experiment be contracted into so narrow a Compass, as the Holding the Vial in one Hand, and bringing a Finger of the other to the Cork-Wire, which evidently proves the Force, &c. to be generated at the Vial.

What

* I never could observe that Flash of Light in any other Vials: If they are lined with Silver-Leaf, the Light produced is of a beautiful Green.

What confirmed me the more in my Opinion, that the grand Eruption was at the Lining of the Vial, were the three following Experiments.—First, Mr. *Franklin*, of *Philadelphia*, informs us, that if the Coating of the Vial be electrified, the Shock will be given from that.—The Experiment is thus made :

Take hold of the Cork-Wire, and electrise the Coating, by bringing it to the excited Apparatus, by which Means the electrical Fluid will be collected and fixed at the Coating ; for bring the Coating from the excited Apparatus to a Finger of the other Hand, and the Fire, Explosion, and Shock, succeed in the same Manner as in the common Way, which shews that the Force was propagated from the metalline Substance in contact with the Vial.

Secondly, By another Experiment of Mr. *Franklin's* it appears, that the electrical Fluid at the Vial, which gives the Shock, is first detained and fixed in a particular Manner between the electric and non-electric, *viz.* between the Glass and the Gilding.—He informs us in his Letters on Electricity, Edit. 2d. Page 32, that,

“ A thin glass Bubble, about an Inch Diameter, weighing only six Grains, being half filled with Water, partly gilt on the Outside, and furnished with a Wire-Hook,
“ gives

“ gives, when electrified, as great a Shock as
“ a Man can well bear. As the Glass is
“ thickest near the Orifice, I suppose the
“ lower half, which being gilt, was elec-
“ trified, and gave the Shock, did not exceed
“ two Grains ; for it appeared, when broke,
“ much thinner than the upper half.—If one
“ of these Bottles be electrified by the Coat-
“ ing, and the Spark taken out through the
“ Gilding, it will break the Glass inwards
“ at the same Time that it breaks the Gild-
“ ing outwards.”

Which could not be, had it been either without-side of the Gilding, or within-side of the Bubble.

Thirdly, The ingenious Dr. Bevis's Method, where the Experiment is contracted into a yet narrower Compass, by gilding a large thin Sash-pane of Glass on both Sides, leaving a Margin all round ungilt : Such a Pane of Glass, if laid on one Hand, and the upper Side electrified, by communicating with a Wire or Chain suspended to the excited Apparatus, will, at bringing a Finger of the other Hand to the Gilding on the upper Side, give a Shock equal to that from a gilded Vial ; and this, whether the Circuit be compleated by thus joining it at the Gilding of the Pane, or whether it be compleated at any distant Part of the excited Apparatus, provided it be done before the gilded

Pane be removed from the Wire which electrifies it.

The gilded Pane of Glass I make Use of is in a circular Form, encompassed with an iron Frame; to this Frame is fixed a small Handle, by which Means it may be as commodiously made Use of as the Vial.

N. B. First, If the Glass of the Vial or Sash-Pane exceed a certain Thickness, the Experiment will not then succeed ; because, as the Vacuum for this Reason cannot be restored, and the electrical Fluid is by that Means hindered from moving compleatly round, the Consequence is, that no Motion is produced in any Part of the Circuit, and no greater Spark is observed, than if the Vial or Sash-Pane were not concerned in the Experiment.

But, supposing the Glass of the Vial or Sash-Pane were of a proper Thickness, and the Experiment succeeds ever so well ; yet if another Bit of Glass of the same Thickness intercept at any other Part of the Circuit, no one in the Circuit (although ever so far from this additional Bit of Glass, and ever so near the electrified Vial or Pane) is sensible of the least Emotion ; which is a farther Proof, that if it cannot move compleatly round the Circuit, it then does not move in any Part of it.

N. B. Second, It seems absolutely necessary to remember, that great Facility by which

which this subtle Fluid moves through all dense non-electrical Bodies into the Earth*, so clearly proved by the Observations on the second capital Experiment in my former Essay, Page 22, and repeated in this at Page 46.

To apply the foregoing Reasoning, First, Since the grand Explosion which generates the Force, and propagates the Shock, is by the Help of Dr. *Bevis's* Sash-Pane, traced to the inner Surface of the Vial †.

Secondly, That a Vacuum is there formed by the sudden Expansion, which was exemplified, by considering the Vacuum formed at the Firing of a Gun, and illustrated by the Experiment of the Cistern of Water and leaden Pipe ‡.

Thirdly, The Readiness, as well as the great Facility of the electrical Fluid to pervade the Glass, and arrive at the Vacuum, as appears by Mr. *Hawksbee's* Experiment §.

And, Fourthly, We are informed by Experience, that the Effects of the *Leyden* Experiment are nearly the same, whether the Circuit be long or short, regular or irregular.

Quæry.

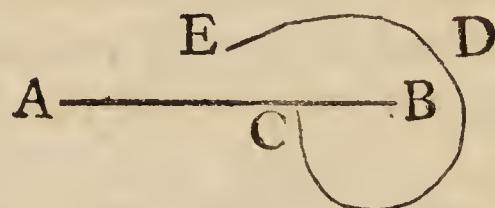
* From the Effects of the *Leyden* Experiment, the like Propensity is observed of moving through all dense non-electrical Bodies throughout the Circuit to restore the Vacuum, formed by the sudden and violent Expansion at the Explosion or bursting forth of the electrical Fire, whether at the Gilding on the Inside of the Vial, or the Gilding at the electrised Surface of the Sash-Pane.

† Page 111. ‡ Page 87. 89. § Page 94.

Quæry. From these Premises, together with the Effects, we observe, May we not safely conclude, that the violent Expansion generates a Vacuum? Secondly, That the Vacuum is as instantly supplied through the thin Glass *, with Æther from the undermost Hand: Thirdly, This again as instantly supplied from the whole Circuit; and the whole Circuit of Æther hurried on by the first Expansion at the electrified Surface of the gilded Pane.

That this may appear more plainly to the Understanding,

Let AB represent the Length or Breadth of the Square, or the Diameter of the circular Pane of Glass: CDE a circular Wire: The End C communicating with the Gilding at the under Side of the Pane.



Whenever the Gilding at the upper Surface of the Sash-Pane is electrified, it does not readily depart from it; but when let alone to itself, frequently remains for a very considerable Time after, closely surrounded and guarded on all Sides by Electrics *per se*, viz. the circumambient Atmosphere and the Glass; but no sooner is one End of the non-

* For, as was before observed, the Experiment will not succeed if the Glass exceed a certain Thickness.

electrical Circuit (in this Experiment, the End E of the circular Wire) brought near it, but it breaks forth from its confined State, and darts with the utmost Violence into it, leaving a Vacuum behind it; which is as instantly restored through the Glass of the Pane, from the other End C of the Wire, and this again as instantly supplied from the electrical Fluid in the Circuit, which rushes like a Torrent, and follows it.— Thus, all to Appearance, is performed in the same Moment of Time, and with the same Impetuosity throughout the whole Circuit (although ever so greatly extended) as at the very Part where it began; and to use Mr. *Franklin's* Expression, “Each Particle pushes its Neighbour quite to the farther End.”

I am very sensible, that after all that can be said on this abstruse Phænomenon, it must be easier from the Premises just laid down, to form a much clearer Idea of the Manner the circulating Shock is produced, and propagated, than from a Multiplicity of Words only, although as compleatly explained as the present Description falls short of it; for my own Part, I am conscious of nothing compleatly performed, but a sincere Endeavour of discovering what might be some Way or other useful, and of communicating the same in an intelligible Manner.

If it be replied, that after all this Point seems to be laboured: It may be answered,

I know not one Thing in the Premises that can be spared, or that is not absolutely necessary to explain the Appearance, so as that it may seem tolerably clear, and consequently, that so far I have not exceeded Sir Isaac Newton's first Rule of Reasoning. Does it not seem agreeable to Reason to suppose, from Mr. Franklin's Experiments,

First, That the electrical Fluid is detained at the Junction of the Gilding on the Glass? Secondly, From other Experiments, that at the Approach of the End E of the circular Wire, it explodes and rushes into the same Wire, leaving a Vacuum; which is, Thirdly, as instantly supplied through the thin Glass from the lower End C of the circular Wire? And, Fourthly, Does it not appear from the Effects of those Kinds of Experiments, that the electrical Fluid moves through all Circuits in the very same Manner, whether they are long or short, regular or irregular?—Can one of these Premises be wanting, and yet the whole seem agreeable to Reason and Experience?

Lastly,

Lastly, Concerning the Usefulness of the electrical Fluid, when applied as a Remedy to human Diseases and Maladies.

HERE it must be owned, those Gentlemen Inquirers have shewn an Air of recommending to the Public the Perusal of my Performance; but whether by a real Design of so doing or not, may perhaps more plainly appear, by considering the Way and Manner in which they delivered their Sentiments.

A N I M A D V E R S I O N S.

But his Book may, at least, be of as much Advantage to Society, as many others that are written in a more scientifical and more elegant Manner; the removing those Distempers to which human Nature is subject, being of infinitely greater Consequence than many of our most refined philosophical Speculations.—Of this Application of Electricity, the Author has treated very fully, enumerating the Cautions necessary to be observed, in order to render the electrical Shocks useful; obviating the several Objections made to the medicinal Uses of Electricity, and accounting for the Miscarriage of the several Attempts of that Kind made by others.—The following Instances will shew what Success

cess he has had in curing Diseases by Electricity.

REMARK.

Then, to shew what Success I had had, they transcribe out of the whole Number four of the Cases only, namely, 14th, 19th, 30th, 31st; and this, without so much as giving the Reader the least Hint that he was to expect any more ; then, consequently, if he was to expect no more of those Applications, and the Pamphlet written in so mean and despicable Language, by one intirely ignorant in Philosophy, it might well be presumed, few would think it worth the Perusal.

I am not so vain, or so unreasonable, as to expect them to have transcribed every Case ; but if they had really designed to give it a Character sufficient to recommend it, it might have been expected (at least) to hear them inform their Readers, that in the Book itself they would meet with many more Applications of the same Kind, equally remarkable ; this was the least they could have said, had they designed to recommend the Perusal.

Then follows : — — — And we could wish they would excite others to make Experiments of the same Kind, that it may be finally determined, whether Electricity may, or may not, be rendered useful in medicinal Intentions. Quæry, Can it indeed still be
rea-

reasonably questioned, whether there is any just Grounds for believing that Electricity may be rendered useful in that Way.

Had this Account, under Inspection, of curing Diseases by Electricity, come from any remote Corner, there might have been some Reason to doubt, whether the Facts therein-mentioned were genuine; but can it seem probable, that I should think to impose on the whole City in which I dwelt, in so gross and barefaced a Manner, as I must had there been no such Cures wrought.

Must it not appear very extraordinary, that I should think of publishing such a Variety of them in a Pamphlet prepared for the same Purpose; where the Names of so many of the Patients were prefixed; most of them on the Spot, or near at Hand, ready to detect the Fraud, had it been such, and yet, that I could think of doing all this with Impunity: This must appear at first Sight too inconsistent to be admitted, and consequently Electricity may be rendered useful in medicinal Intentions; or else what would appear a downright Contradiction, viz. that all the Cures mentioned in my Pamphlet, and many Hundreds beside, not written down*, were

the

* Since I published that Essay, Mrs. Cox, a Gentlewoman of Birmingham, who had made Use of Electricity for a Kind of pleuretic Complaint, seemed a little out of Humour because she did not find an Account of her own Case in my Cata-

the Effects of mere Chance, notwithstanding many of them were sure to happen, whenever those Experiments were applied in particular Disorders ; for I can assure the Reader, in many Cases it seldom or never fails.

In a Word, I can truly say I scarce ever knew any who attempted Trials of this Kind that did not succeed ; and consequently, if those Gentlemen or others would but repeat some of the same Experiments, and in the same Manner as I have directed at the End of each particular Case in that Essay, they would meet with equal Success.

N. B. I would not be understood to mean, that all Disorders, in all Trials, yield alike to those electrical Applications, for different Disorders yield differently ; and even the same Treatment of the same Disorder, in different Persons, will not be attended with equal Success, any more than when treated in the common Way.

But notwithstanding the Success which attended those electrical Applications, yet, from eight or nine successive Years of Experience, I could never observe any absolute

Catalogue of Cures.—I told her my Reason for it was, I did not think it a Cure sufficiently remarkable ; she replied, she thought it a very great one, as she could have no Relief from other Means, or to the same Effect.

Many besides have greatly extolled Cures performed on them, which yet I did not think were worthy to be ranked with the rest.

healing Quality in the electrical Fluid, unless an Attenuation of the bodily Fluids, and that which promotes a free Circulation, may be allowed to be such.

Being some Time since in Company with an ingenious Gentleman of the Faculty, and the Conversation turning on the Subject of Electricity, and the many and various Cures which had been effected by Means of those electrical Applications, he assured me, it had been the Opinion of some very eminent Physicians, that there was, in Nature, such a Thing as a real Panacea; and if so, it was his Opinion, that Electricity bid as fair for it as any Thing: And although an absolute Catholicon must, in the Nature of Things, be impossible, yet that which proves a Remedy in the greatest Variety of Complaints, must, as he justly observed, be allowed to lay in the fairest Claim to it.

But nothing can be more certain, than that neither the electrical Method of treating Disorders, or any other can be expected to arrive at any considerable Degree of Perfection, till administered and applied by those learned Gentlemen of the Faculty, who, having a thorough Knowledge, not only of the Structure of the human Body, but the various Distempers incident thereto, with their several Causes, must be the only Hands from

from which we can expect the greatest Success in either.

N. B. Sudden as well as acute Pains are, for the most Part, instantly cured by those electrical Applications.

P O S T S C R I P T.

IF I have been hitherto mistaken, in supposing those Gentlemen Enquirers Strangers to Electricity ; and, if I have been guilty of any material Errors, which I am at present not sensible of, I should be very thankful if they would condescend to correct such Errors in a candid and good-natured Manner : Since all will allow the Subject to be highly worthy of Consideration, and as I can think of no Method so effectual, to clear up any doubtful Part of it, as a candid Controversy; so I shall gladly return as candid an Answer, and retract whatever appears erroneous.——I am the less apprehen-

sive of any material Error appearing, because I can truly say, that what I have delivered has been first faithfully examined, and proved by Experiments ; so that whatever Objections may be made to it, I hope to meet with civil Treatment, whether such Objections may come from those Gentlemen themselves, or, *under Colour*, from their Agents ; for I should be very sorry, if a Subject of such Importance, should, instead of being fairly controverted, end in a wrangling Dispute after Captures and Reprisals made, *viz.* Alternate Detraction and Cavilling, which is very often the Case. And,

As it is entirely out of my Power to palliate and gloss over the Subject, and make that appear true which is in reality false, so an Error may be the more easily detected : 'Tis presumed, the having delivered my Sentiments in plain Language, is no real Disadvantage to the Subject, provided my Meaning be sufficiently intelligible ; for is it not generally allowed, that many Things which have been written in a florid Style, and in a pompous Manner, have, instead of illustrating the Subject they were pretending to explain, rendered it the more obscure and unintelligible, by artfully blending Truth and Falshood in such a Manner, as to confound each other, so as not without some Difficulty to be distinguished by the Majority of Readers ;

Readers; consequently, whenever a Subject appears mysterious, a plain intelligible Manner of treating it, is preferable.

Permit me to conclude with that humble Request of the illustrious Sir *Isaac Newton*, which, although in him it might well have been spared, yet a more modest one cannot well be exhibited for the most defective Performance, even for this of mine.

“ I heartily beg that what I have here
“ done, may be read with Candour, and
“ that the Defects I have been guilty of,
“ upon this difficult Subject, may be not so
“ much reprehended as kindly supplied, and
“ investigated by new Endeavours of my
“ Readers.” Preface to his *Princip.*

F I N I S.

Just published by the same Author,

T H E

SUBTIL MEDIUM PROVED,

O R, T H A T

Wonderful Power of NATURE,

So long ago conjectured

B Y T H E

Most Ancient and Remarkable Philosophers,

Which they called sometimes

Æ T H E R,

But oftener

ELEMENTARY FIRE, VERIFY'D.

S H E W I N G

That *all* the *distinguishing* and essential Qualities ascribed to ÆTHER by them, and the most eminent modern Philosophers, are to be found in ELECTRICAL FIRE, and that too in the utmost Degree of Perfection.

G I V I N G

An Account not only of the Progress and several Gradations of ELECTRICITY, from those ancient Times to the present;

But also accounting

First, For the natural Difference of electrical and non-electrical Bodies.—*Secondly*, Shewing the Source or main Spring from whence the electric Matter proceeds.—

Thirdly, Its various Uses in the animal Economy, particularly when applied to Maladies and Disorders incident to the human Body. Illustrated by Variety of known Facts.

—*Fourthly*, The Method of applying it in each particular Case. And,—*Lastly*, The several Objections brought against it accounted for and answered.

M E M O I R S
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Sir THOMAS HUGHSON
A N D
Mr. JOSEPH WILLIAMS,
With the remarkable
History, Travels, and Distresses,
O F
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The Whole calculated
For the Improvement of the MIND and
MANNERS; and for a becoming and use-
ful ENTERTAINMENT for the YOUTH of
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In F O U R V O L U M E S.

Torquet ab Obscenis jam nunc Sermonibus Aurem.

HORACE.

To be had of WILLIAM FENNER, at the Angel and
Bible, in Pater-noster-row.

SELF-KNOWLEDGE.

A

TREATISE,

SHEWING THE

NATURE and BENEFIT

OF THAT

IMPORTANT SCIENCE,

AND

The WAY to attain it.

INTERMIXED

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